

Ministry of Defense of the USSR

# Firing Manual

12.7 mm Machine Guns Models 1938/46 and 1938

**B**

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## INTRODUCTION

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1. The 12.7 mm machine gun, model 1938/46 ~~(Fig. 1)~~ and the 12.7 mm machine gun, model 1938, Degtyarev-Shpagin heavy caliber (DSHK) ~~(Fig. 2)~~ are simple in design and reliable under combat conditions. The model 1938/46 machine gun is a modernized model 1938 gun.

2. The 12.7 mm machine gun is an automatic weapon designed for firing at aerial targets and for combat against enemy fire points and his personnel protected by light armor.

↖ Effective firing range for the gun on fire points is 1500 m; on targets protected by light armor not exceeding 10 mm, 800 m, and against an aircraft, 1600 m.

↖ Sighting range of the gun when firing on a ground target is 3500 m. Maximum range of bullet flight is about 7000 m.

3. Depending on the nature of the target, machine gun fire is conducted in short bursts (5-10 rounds), long bursts (15-20 rounds), and continuous fire.

Combat practical rate of fire of the machine gun is up to 80 rounds per minute.

4. Cartridge feed is performed from metallic belts designed for 50 cartridges. The belt is packed in a metal box.



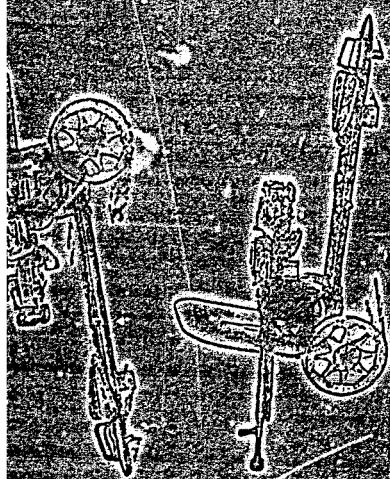


Fig. 1: General view of 12.7 mm machine gun, model 1938/46

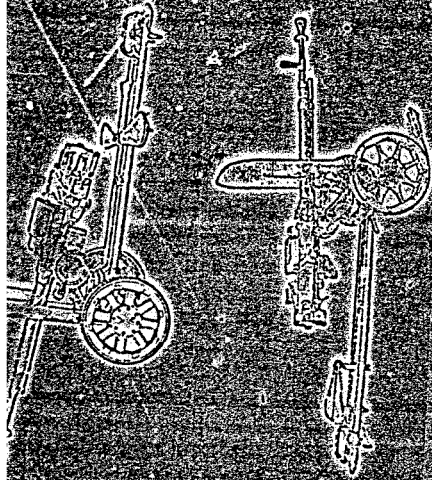


Fig. 2 General view of 12.7 mm machine gun (DSHK), model 1938

#### 5. Basic machine gun data:

Weight of machine gun on mount with box for belt, kg.....	about 157
Weight of body of machine gun, kg.....	34.0
Weight of mount (without shield and shoulder piece, kg).....	94.5
Weight of shield, kg.....	24.5

Weight of shoulder piece, kg.....	30
Weight of barrel (assembled), kg.....	12.6
Weight of cartridge belt, kg.....	1.0
Weight of box with cartridge belt (without cartridges), kg.....	4.4
Weight of box with loaded cartridge belt, kg.....	11.0

Weight of 12.7 mm cartridge with armor piercing  
bullet (B-32), kg .....0.125-0.137

Cartridge belt capacity (number of cartridges)..... 50

Length of machine gun on mount, mm ..... 2328

Width of machine gun on mount, mm ..... 708

Height of machine gun with shield, mm ..... 965

Height of machine gun without shield with  
rear sight depressed, mm ..... 755

Length of line of sight, mm ..... 1113

Length of barrel with muzzle brake, mm ..... 1069

Sighting distance:

- when firing model 1938/45 machine gun, m ..... 3300
- when firing model 1938 machine gun, m ..... 3500

Length of bullet range, m ..... 7000

Number of grooves ..... 8

Initial velocity of bullet, m/s .....830-850

Rate of fire, rounds per minute .....540-600

Practicable rate of fire, rounds per minute ..... 80

## PART I

# CONSTRUCTION OF THE 12.7 mm MACHINE GUN MODEL 1938/46, ITS HANDLING, STORAGE, AND MAINTENANCE

## CHAPTER I

### UNDERSTANDING THE CONSTRUCTION AND OPERATION OF THE 12.7 mm MACHINE GUN, MODEL 1938/46

#### GENERAL ASPECTS

6. The machine gun consists of the following main parts and mechanisms: barrel, receiver, sight, bolt support, bolt, trigger housing, back plate, chamber, and universal mount.

7. Automatic action of the machine gun is based on the principle of use of energy of the powder gases escaping from the bore of the barrel through a special transverse (gas escape) port.

8. Locking of the barrel by the bolt is accomplished by two recoil lugs removed in the direction of movement of the firing pin and resting in the lugs of the receiver.

9. The barrel is air cooled. Ammunition feed is performed through the slide-type receiver of a metallic belt. The design of the receiver provides for two-sided (right and left) feed of the machine gun. The rear sight is open leaf.

Only automatic fire can be conducted with the machine gun.

10. The machine is mounted on the 1938 model universal mount which make it possible to conduct fire against ground and air targets. An antiaircraft sight is attached for firing at aircraft.

11. In order to conduct fire, it is necessary to load the machine gun, aim it at the target, and squeeze the trigger.

During firing, part of the powder gases following along the bore behind the bullet, after the bullet has passed the gas-escape port in the barrel, rushes into the channel of <sup>the</sup> gas chamber and by acting on the gas piston throws it backward. The bolt support, connected with the rod of the piston, also goes back, drawing back first the firing pin and then the bolt, and compresses the recoil firing spring. The movement of the bolt backward begins after this, as its firing pin stop goes out of the firing lugs of the receiver and enters fully into the lateral grooves of the breechblock housing after the exit of the thickened part of the firing pin from the bolt backward.

Contraction of the recoil lugs takes place as a result of the action of the guides of the shaped slot of the bolt support on the lower lugs of the recoil lugs. After complete exit of the recoil lugs from behind the operating shoulders of the receiver, the bolt is moved backward from the bolt support. Along the path of movement backward, ~~the bolt support~~ by a lever turns the handle of the bolt support together with its pivot. The pivot of the lever handle, by its lug, rotates the slide handle connected with the slide. The slide moves off to the left, and the upper pawls drop in behind the next cartridge. With the movement backward of the bolt support, the slide moves the belt in the receiver by one cartridge.

Return of the movable system to the extreme forward position takes place under the action of the main return spring.

With the forward movement, the bolt drives by a feed rib on the next cartridge in the longitudinal receiving opening of the receiver and delivers it to the cartridge chamber. Occupying the extreme forward position, the bolt stops and the bolt support together with the firing pin continues to move forward. The thickened part of the firing pin raises the recoil lugs to the side, and the latter enter by their ends into the shoulders of the receiver. This achieves complete and reliable locking of the barrel bore at the moment of firing.

Continuing movement forward, the firing pin hits the striker, the striker comes out of the bolt channel and breaks the primer of the cartridge. Firing occurs.

## CONSTRUCTION OF THE CARTRIDGE

12. The live cartridge (Fig.3) consists of the case, primer, powder charge, and bullet.

13. The case serves to join all the parts of the cartridge. It has: a body, inside of which the powder charge is contained; a <sup>6</sup>chamber for supporting the transition cone; a neck into which the bullet is placed; a groove for the hook of the extractor and a base.

The base of the case has: a recess for the primer; an anvil on which the primer is broken by the striker; two cartridge case vents, through which the fire from the primer reaches the powder.

14. The primer serves to ignite the charge. It consists of a brass primer cap with the percussion component pressed into it and covered with foil.

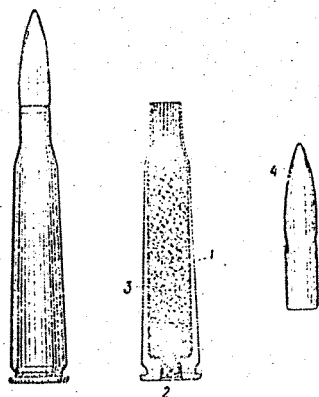


Fig.3 Live cartridge:

1- case; 2- primer; 3- powder charge; 4- bullet

15. The powder charge consists of smokeless powder. During burning of the charge, powder gases are formed, the pressure ejects the bullet from the bore of the barrel and all the movable system is activated to produce the next round.

16. For firing the heavy caliber machine guns, B-32 and BZT bullets are used.

The nose of the bullet is colored: armor-piercing incendiary (B-32) - black with a red stripe, armor-piercing incendiary tracer (BZT) - violet with a red stripe.

CHAPTER II  
DISASSEMBLY AND ASSEMBLY OF THE MACHINE GUN  
GENERAL DIRECTIONS

17. Disassembly of the machine gun is performed for cleaning, oiling, inspection, replacement/repair of parts. Excessively frequent disassembly is harmful since it accelerates wear of the machine gun parts; therefore, instruction in disassembly and assembly on service machine guns is permitted only in exceptional circumstances.

18. The following rules are to be observed in disassembling and assembling the machine gun:

- before disassembly, check to see that there is not a cartridge in the longitudinal magazine opening of the base of the receiver and in the cartridge chamber, and also whether the movable system is released from the sear notch;
- use only serviceable instruments for disassembly;
- in removing the parts of the machine, lay them out in the order of disassembly;
- handle parts carefully, <sup>AVOID</sup> not ~~permitting~~ excessive force and sharp blows; when unscrewing any part, first move it from its place with a wrench and then unscrew it by hand; when screwing on - first turn by hand, and then secure with a wrench.

19. Perform partial disassembly of the machine gun during repeated cleanings after firing, after training without firing, and in other cases when the machine gun has not undergone severe soiling.

20. Perform complete disassembly of the machine gun when its mechanisms have been severely soiled, when placing the <sup>weapon</sup> ~~machine~~ in prolonged storage, and ~~also~~ when replacing summer lubricant with winter, and vice versa.

21. Complete disassembly is performed under the supervision of the platoon commander.

## PARTIAL DISASSEMBLY OF THE MACHINE GUN

22. Perform partial disassembly of the machine gun in the following order:

a) Disconnect the guide tube of the piston from the barrel:

- loosen the bolts of the machine gun pivot on the mount, turning them in the same direction;
- stand in front of the carriage of the mount with back toward the muzzle part of the machine gun, bracing the left foot on the carriage of the mount, grasping the guide tube of the piston with both hands (Fig.4), pull it toward you as far as it will go and turn from right to left until the stop of the tube comes out of the shaped groove of the barrel.

b) Unscrew and remove from the right the coupling pin of the rear mounting of the machine gun.

c) Remove the back plate:

- lift up the sight leaf;
- remove the backplate pin, displacing it to the right with a heavy punch;
- holding the body of the machine gun with the left hand behind the trigger housing, with light blows of a wooden hammer on the base of the base plate from above (Fig.5), separate it from the receiver, while supporting the base plate from below so that it doesn't drop.

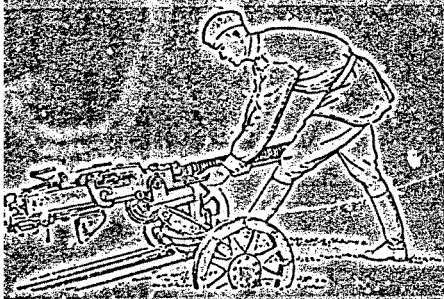


Fig. 4 How to disconnect the guide tube from the barrel

d) Remove the receiver:

- placing both hands behind the lug of the trigger housing, after pressing the large pawls into the rear edge of the receiver (Fig.6) move it backward, if



the receiver does not move under manual force, move it from its place by light blows of a wooden hammer on the forward face of the right lug.

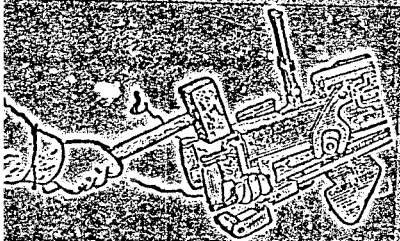


Fig. 5 How to remove the back plate

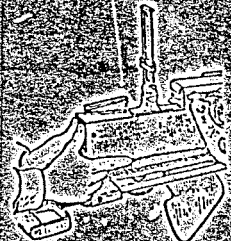


Fig. 6. How to remove the trigger housing

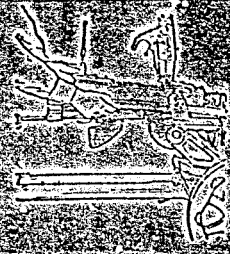


Fig. 7 How to remove the movable system

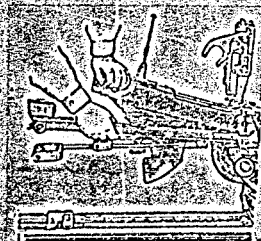


Fig. 8 How to withdraw the movable system from the receiver

e) Remove the movable system:

- swing the receiver upward until it engages with the stop;
- with the palm of the left hand, lower the rear part of the receiver and hold it so that the barrel does not press on the guide tube of the piston (Fig. 7);
- with the right hand, draw the bolt support beyond the handle backward until the bolt comes out of the receiver and, grasping the bolt support, unscrew it from the receiver together with the bolt (Fig. 8); in so doing,



Use the left hand to support the guide tube of the piston.

f) Remove the bolt from the support: with the right hand behind the back end of the bolt, take and lift it upward.

g) Disassemble the bolt: unscrew the striker and remove the recoil lugs.

#### ASSEMBLY OF THE MACHINE GUN AFTER PARTIAL DISASSEMBLY

23. Perform assembly of the machine gun after partial disassembly in the following sequence.

a) Assemble the bolt:

- place the recoil lugs in the side grooves of the bolt frame so that the lower lugs of the supports are turned down;

- place the striker in the channel of the bolt with the horizontal area of the back end up and carry it forward so that the recoil lugs remain compressed.

b) Connect the bolt with the support: direct the back end of the striker into the recess of the shank of the support, and the lower lug of the bolt and the projections of the recoil lugs into the shaped slot of the support

c) Connect the bolt support with the receiver:

- turn the support of the guide tube of the piston to the right;

- with the palm of the left hand, lower the back part of the receiver and support it;

- with the right hand, grasp the support with bolt from below and, guiding the gas piston into the channel of the gas regulator, and the ribs of the support into the grooves of the receiver, <sup>PUSH</sup> send the support forward;

- lower the receiver and press the hand on its back end until it engages with the latch.

d) Connect the receiver: supporting the receiver on the palm of the right hand, direct its longitudinal lugs into the outer grooves of the receiver and <sup>PUSH</sup> send the receiver forward as far as it will go.

e) Install the back plate:

- grasp the back plate with both hands from below and smoothly push it into the vertical grooves of the receiver; if the back plate will not move to the limit with the hands, send it in with light blows of a wooden hammer along

the lower part of the back plate; in so doing, support the body of the machine gun with the hand from above behind the back part of the receiver;

- install the pin from the right side;
- place the sight leaf on the back plate.

f) Connect the guide tube of the piston <sup>to</sup> with the barrel:

- stand in front of the carriage of the mount facing the machine gun, press the left foot against the carriage of the mount, grasp the guide tube of the piston with both hands, draw it toward you as far as it will go and turn from left to right until the support of the guide tube of the piston sets in the shaped groove of the barrel;
- secure the pivot clamps on the mount.

24. When assembling the machine gun, check the correct operation of the separate mechanisms and the machine gun as a whole.

With correct assembly, the movable system set in the rear position, with pressure on the trigger, forcefully moves into the forward position.

When setting the safety on "Stop" and squeezing the trigger, the movable system is reliably held by the trigger sear.

#### COMPLETE DISASSEMBLY OF THE MACHINE GUN

25. Complete disassembly of the machine gun is performed in the following sequence:

a) Perform partial disassembly as indicated in item 22.

b) Separate the gas piston with the rod, the recoil return spring, and the guide tube of the piston from the bolt support:

- separate the piston pin spring with the aid of a punch;
- knock out the pin to the right;
- placing the bolt support perpendicular with the gas piston down, with the left hand set the guide tube of the piston downward, with the right hand set the wrench-screwdriver in the groove of the rod (Fig.9) and smoothly lower the tube;

- holding the wrench on the rod with one hand, with the other hand, unscrew the sleeve together with the bolt support and remove them from the rod;

Note: If the sleeve will not unscrew with the force of the hand, move it from its place with a wrench; in removing the bolt support, with the second crew member, hold the rod with the guide tube of the piston.

- again set the guide tube of the piston downward and remove the wrench from the rod;

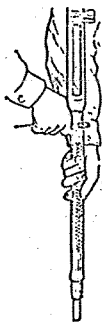


Fig. 9 How to separate the gas piston with rod

- smoothly allow the guide tube of the piston to go upward until the recoil return spring is fully expanded;

- remove the guide tube of the piston from the recoil return spring;

- remove the recoil return spring from the rod.

c) Separate the extractor from the bolt:

- place the bolt with the right surface up and, holding the extractor

with the left thumb, with the aid of a large punch, knock out the extractor pin;

- unscrew the ejector and its spring from the recess of the bolt;

d) Separate the ejector from the bolt:

- holding the bolt just as when separating the extractor, with the aid of a large punch, knock out the ejector pin;

- unscrew the ejector from the inclined channel of the bolt.

e) Separate the striker from the bolt:

- holding the bolt just as when separating the extractor, with the aid of a large punch, knock out the striker pin;

unscrew the striker from the channel of the bolt.

f) Separate the receiver from the receiver housing:

- carefully straighten the ends of the cotter pin of the receiver spindle nut and with a small punch, knock out the cotter pin from the opening;

unscrew the nut;

- knock out the pin of the receiver to the right and lift up the receiver from the ear of the receiver housing;

- separate the cover of the receiver with the base of the receiver housing.

g) Remove the lever of the bolt support from the cover of the receiver;

- knock out the cotter pin of the lever spindle of the support and unscrew the nut;

- take away the lever of the support to the right with its pin and remove the washer;

- remove the pin of the support lever from the cover of the receiver, moving it to the left;

- remove the second washer from the spindle;

- push out the spindle of the lever of the slide and remove the lever and slide, do not separate the feeding pawls from the slide.

h) Disassemble the locking mechanism; depress the plunger; push out the supporting plate, the locking device and its spring.

i) Unscrew the backing screw and remove the catch of the receiver and its spring.

j) Remove the regulator from the gas chamber:

- straighten the ends of the cotter pin of the regulator nut and with a punch, knock out the pin from the opening;

- unscrew the nut;

- notice the figure on the regulator standing opposite the mark on the gas chamber, <sup>THEN</sup> after which, after moving the regulator backward, remove it from the gas chamber.

k) Separate the barrel from the receiver housing:

- unscrew the muzzle brake from the barrel;

- unscrew the nut of the barrel wedge;

- move the wedge to the left and move the washer and nut of the barrel wedge upward;

move the barrel forward, unscrew it from the receiver housing.

l) Further disassembly of the machine gun mechanisms is performed only in an ordnance workshop.

## ASSEMBLY OF THE MACHINE GUN AFTER COMPLETE DISASSEMBLY

26. Assembly of the machine gun after complete disassembly is performed in the following sequence:

a) Connect the barrel with the receiver housing:

- set the rear end of the barrel in the channel of the receiver housing and send it backward as far as it will go;
- place the nut of the wedge in the washer so that its faceted part goes through the opening of the washer in the right wall of the receiver housing.
- set the wedge to the left in the cross opening of the receiver housing; screw the muzzle brake onto the barrel.

b) Connect the regulator with the gas chamber:

- set the regulator by the end in the longitudinal channel of the front lug of the gas chamber and align it with the mark on the right wall of the gas chamber to that figure which stood opposite the mark prior to disassembly;
- screw the nut on the regulator as far as it will go, having aligned the opening of the regulator for the cotter pin with the notch in the nut;
- set the cotter pin in place and spread its ends.

c) Assemble the receiver:

- connect the slide with the base so that the feed pawls are on the left side;

- assemble the lever of the slide so that the forward arm enters the slot of the slide and the fork of the second arm <sup>is</sup> ~~will be~~ turned to the left side of the receiver;

- assemble the locking mechanism: place the support plate in the slot on the left side of the base; set the spring of the locking device and the locking device in the channel; depress the plunger with a punch and place the second support plate in the slot from the right side until it stops at the punch; release the punch and <sup>Move</sup> ~~and send~~ the support plate <sup>To</sup> ~~as far as the~~ place where the end of the locking device <sup>will</sup> ~~must~~ pass through the opening of the plate;

- assemble the catch of the receiver: place the catch with spring in its recess and <sup>Move</sup> ~~send~~ them forward as far as they will go; tighten the screw of the catch holding the catch in the recess;

put the washer on the spindle of the lever;

place the spindle in the cross opening of the receiver cover from the left side and move it right as far as it will go, then put the second washer on the spindle;

holding the spindle of the lever with the left hand back of its top, with the right hand, put the lever with the rectangular opening on the spindle;

-tighten the nut on the spindle as far as it will go, aligning the opening of the spindle under the cotter pin with the recess in the nut;

- Insert the cotter pin and spread its ends.

d) ~~Connect the receiver with the receiver housing;~~

- align the openings for the spindle of the receiver, insert the lug of the base of the receiver in the hole of the cover;

-holding the receiver in the left hand, put its hole on the lug of the receiver housing;

-insert the spindle of the receiver from the right;

- lower the receiver onto the receiver housing;

- align the opening of the spindle under the cotter pin with the recess in the nut, tighten the nut on the spindle as far as it will go;

- insert the cotter pin and extend its ends.

e) Connect the striker with the bolt:

- insert the striker in the channel of the body of the bolt with the horizontal face up;

- from the left side, insert the striker pin in the opening of the bolt, and with a hammer and punch, send it as far as it will go;

f) Connect the ejector with the bolt:

- insert the ejector in the opening of the bolt, flat side back and up;

- from the left side, insert ejector pin into the opening and with a hammer and punch, send it as far as it will go.

g) Connect the extractor with the bolt:

- insert the spring and then the extractor in the recess of the bolt and align the clearance for the extractor with the opening of the bolt for the spindle;

- press on the head of the extractor with the left thumb, insert the extractor spindle from the left into the opening; with a hammer and punch, send the spindle forward as far as it will go.

h) Put the return spring on the rod of the gas piston and the guide tube of the piston and tighten the bolt support;

- holding the rod of the gas piston perpendicular, as in disassembling, put the return mainspring on the rod;

- put the guide tube of the piston on the return mainspring so that its rear end will be turned up;

- smoothly seat the guide tube of the piston downward so that the grooves under the wrench on the rod are visible;

- put the wrench-screwdriver on the grooves of the rod and smoothly lower the tube;

- holding the wrench with one hand on the rod, with the other hand, tighten the coupling with the bolt support on the rod until the openings under the cotter pin are aligned;

- again seat the guide tube of the piston downward and remove the wrench from the rod;

- install the cotter pin of the rod in the opening from the right side, and, with a hammer and punch, send it to the left as far as it will go;

- place the spring of the cotter pin of the piston, and, with a small punch, send it as far as it will go.

1) Further assembly of the machine gun is performed as indicated in item 23.

#### DISASSEMBLY AND ASSEMBLY OF THE MOUNT, MODEL 1938 FOR THE MACHINE GUN, MODEL 1938/46

27. The mount is not disassembled, as a rule, in combat. It is permitted to disassemble the mount only during repair in ordnance workshops <sup>or</sup> and in case of severe soiling or rusting (after prolonged training, firing, and so forth), if it is not possible to clean it without disassembly.

28. Disassembly of the mount is performed in the following sequence:

a) Remove the shield from the mount;

- unfasten the handles of the shield bracket clamps;

- take the shield out of the slots of the mount swivel.

b) Remove the body of the machine gun from the mount:

- set the tipping part of the mount in a horizontal position and tighten it with the rough elevating and traversing clamps;
- unscrew the bolts of the trunnion caps of the trunnion seats;
- fold back the trunnion seat caps;
- unscrew the rear fastening bolt of the body of the machine gun from the slide and withdraw the bolt;
- remove the body of the machine gun from the mount.
- c) Unscrew the slide stop screw with a screwdriver.
- d) Remove the slide with the bolt actuator lever.
- e) Unscrew the fine aiming clamp nut and take off the clamp.
- f) Remove the cotter pin of the pivot nut of the tipping part of the mount.
- g) Unscrew the pivot bolt nut with a wrench.
- h) Remove the pin of the tipping part of the mount.
- i) Lift the upper and lower firing bases of the mount upward until they come out of the pivot.
- j) Put aside the upper and lower firing bases of the mount so that the cap of the fine aiming mechanism screw will be removed from its pin located on the elevating base.
- k) Remove the limiting bolt from the slanted groove of the bracket of the lower base.
- l) Unscrew the two screws of the bracket of the fine aiming mechanism.
- m) Remove the bracket with the fine aiming mechanism from the bracket base. Remove the fine aiming mechanism from the bracket.
- n) Remove the cotter pin of the yoke spindle (upper clamp).
- o) Remove the pin of the yoke, separating its forward part from the elevating clamp linkage.
- p) Remove the linkage together with elevation clamp lever.
- q) Take the elevation base from the pivot, folding the forward part of the yoke forward.
- r) Unscrew the bolt of the horizontal clamp with a screwdriver.
- s) Take off the horizontal yoke, spreading its parts aside.
- t) Remove the pivot from the base of the mount.
- u) Unscrew the lock of the carriage and remove the carriage from the mount.
- v) Remove the upper tipping plate from the lower tipping plate.



w) Further disassembly of the mount is performed in an ordnance workshop.

29. Assembly of the mount is performed in the following sequence:

- a) Connect the upper tipping base with the lower tipping base.
- b) Connect the carriage with the mount.
- c) Connect the pivot with the base.
- d) Set the pivot in the opening in the base.
- e) Place the yoke on the pivot and tighten the clamp bolt.
- f) Connect the elevating base with the pivot.
- g) Insert the linkage with the vertical clamp lever.
- h) Insert the pin of the yoke and connect it with the elevation clamp linkage.
  - 1) Insert the cotter pin of the yoke pin of the elevation clamp.
  - j) Connect the fine aiming mechanism to the bracket.
  - k) Connect the bracket with the fine aiming mechanism to the bracket.
  - l) Tighten the screws of the fine aiming mechanism bracket.
  - m) Set the limiting bolt in the slanted groove of the lower base bracket.
  - n) Place the cap on the fine aiming mechanism screw.
  - o) Connect the tipping part of the mount with the pivot.
  - p) Place the pin of the tipping part of the mount in the hole of the pivot.
  - q) Tighten the nut of the pin bolt with a wrench.
  - r) Insert the cotter pin of the nut of the pin <sup>in</sup> of the tipping part of the base.
    - s) Connect the fine aiming with the clamp and tighten its nut.
    - t) Put on the slide with the actuating lever.
    - u) Tighten the slide limiting bolt.
    - v) Connect the body of the machine to the mount.
    - w) Insert and tighten the bolt of the rear fastening of the body of the machine gun to the slide.
      - x) Put on the cap of the trunnion seats and secure them with bolts.
      - y) Secure the tipping part of the base with the rough elevation and traversing clamps.
      - z) Install the shield in the slots of the mount pivot and secure it with the bracket fastening levers.

## REPLACING THE BARREL

30. Replacement of the barrel is performed in the following sequence:

- a) Unload the machine gun.
- b) Disconnect the guide tube of the piston with the barrel.
- c) Separate the barrel from the receiver housing:
  - unscrew the barrel wedge nut;
  - remove the wedge to the left, withdraw the washer of the barrel wedge together with the nut upward.
  - withdraw the barrel from the receiver housing;
  - if the barrel will not come out, - rotate it until it moves out of its place;
  - place the barrel in the channel of the receiver housing, <sup>push</sup> send it back as far as it will go and secure the barrel with the wedge.
- d) Connect the guide tube of the piston with the barrel, seeing that its forward part goes into the longitudinal channel of the gas chamber.

## USE OF THE GAS REGULATOR

31. Machine guns issued to combat units have a regulator mounted on the middle of the gas port; the zero mark of the gas chamber is opposite the figure "3.5" of the gas regulator. Such a setting of the regulator ensures reliable operation of the machine gun under normal conditions up to 1000 rounds.

After firing 1000 rounds, the movable parts of the machine gun operate more energetically (this can be determined from the increased firing rate and also from the energetic throw out of the ejected cartridge cases). As a result of this, <sup>EXCESSIVE RECOIL</sup> strong blows appear which cause <sup>premature</sup> wear, and sometimes failure of parts of the machine gun. In these cases, the regulator must be set on the smallest gas port (figure "28" or "3" of the gas regulator).

Move the regulator of the gas chamber from a smaller port to a larger in the following cases:

- if the machine gun which is fully serviceable, carefully cleaned, and ready for firing frequently malfunctions, causing incomplete withdrawal of the moving parts to the rear position;

- if the movable parts are severely soiled during firing and there is no time to clean the machine gun.

Resetting of the regulator <sup>to</sup> on the next gas port is performed in the following sequence:

- a) Separate the regulator from the gas chamber:
  - straighten the ends of the cotter pin of the regulator nut and remove it from the opening;
  - unscrew the nut and, moving the regulator backward, remove it from the gas chamber.
- b) Clean the port of the regulator and the gas chamber of ~~blackening and soiling~~.
- c) Connect the regulator with the gas chamber:
  - set the regulator in the channel of the front projection of the gas chamber and align the necessary gas port (figure) with the setting mark on the gas chamber;
  - align the opening of the regulator under the cotter pin with the groove in the nut, tighten the nut of the regulator as far as it will go;
  - install the cotter pin and expand its ends.

## CHAPTER III

### MAINTENANCE AND STORAGE OF THE MACHINE GUN

#### GENERAL DIRECTIONS

32. The machine gun is always kept in ~~complete order~~, working condition, and cleanliness. This is achieved through timely and skillful cleaning and lubrication, correct storage of the machine gun, and careful handling.

33. Cleaning of machine guns which are in service is performed:

- in a combat situation, on maneuvers, or in prolonged training in the field - daily, by making use of a lull in fighting or breaks in training;
- after firing - immediately upon the conclusion of firing; in this case, at the firing range (in the field) it is necessary to clean and lubricate the barrel; upon return from firing (training), complete cleaning of the machine gun is performed, and in the course of the next 3-4 days the channel of the bolt is wiped with a clean white wiping rag; if no blackening, fouling, or rust are observed, repeat the cleaning;
- after training, service and duty without firing - immediately upon completion of the training, service, or duty.

34. Lubrication of the machine gun is performed immediately after cleaning. Parts of the machine gun, moving in contact are lubricated during breaks in firing.

35. Cleaning and lubrication of the machine gun is performed by the gunner under the direction of the section commander.

The section commander is required to:

- determine the necessary degree of disassembly, cleaning, and lubrication;
- distribute the work of cleaning and lubrication of parts among the machine gunners;
- check the condition of the tools and the good quality of materials used for cleaning;

- check the correctness and completeness of the cleaning being performed, and after which ~~to~~ give permission for lubrication;
- check the correctness of the lubrication being performed and ~~to~~ give permission to assemble the machine gun and to place it in storage.

The platoon commander is required to observe and supervise the disassembly, cleaning, and lubrication of the machine guns.

36. Cleaning of machine guns under conditions of barracks or camp deployment is performed in places specially set aside for cleaning of weapons, on tables equipped and fitted for this purpose, ~~and~~ In a combat or march situation - on platforms or planks which have previously cleaned of dirt and dust.

37. The utensils for disassembly and cleaning must be in good condition, and all lubricating and wiping materials must be clean and of good quality. Lubricating materials are to be kept in covered containers with appropriate labels, and wiping materials - in boxes or wrapped in dense material for protection against dust and moisture.

38. For cleaning and lubrication of machine guns, use:

- a metal-fouling solution - for cleaning off powder residue and for cleaning parts of the machine gun which have been subjected to the effects of powder gases (barrel, bolt, gas chamber, regulator, piston, muzzle brake);
- rifle grease - for lubricating parts of the machine gun after cleaning at temperatures from  $+50^{\circ}\text{C}$  to  $+5^{\circ}\text{C}$ ;
- AU spindle oil - for lubrication of parts of the machine gun which move in contact during firing;
- No. 21 grease - for lubrication of parts and mechanisms in winter at temperatures from  $+5^{\circ}\text{C}$  to  $-40^{\circ}\text{C}$ ;
- No. 21 grease diluted with pure kerosene (from 10 to 20%), - for lubricating parts and mechanisms of the machine gun at temperatures below  $-40^{\circ}\text{C}$ ;
- gun grease or a mixture of 50% gun and 50% rifle grease - for lubrication of machine guns subject to prolonged storage;
- kerosene - for thinning dripped grease and for removing storage (consistent) grease from parts;

- laundry rags - for lubrication of the barrel bore, for wiping and lubricating parts of the moving system;
- fine cotton rags - for wiping the bore, the mechanisms, and parts of the machine gun before lubricating;
- cotton rags - for removing thick layers of contaminated grease from external parts of the machine gun;
- flaxen tow (cleaned of fragments) - for cleaning the bore of the barrel and external parts of the machine gun.

The use of lubricating and wiping materials which are not prescribed in this chapter is forbidden.

39. Parts of the machine gun which have been subjected to the effects of kerosene must be thoroughly rubbed with tow and then with a dry clean rag.

#### CLEANING AND LUBRICATION OF THE MACHINE GUN

40. The bore is cleaned with a cleaning rod. Place a layer of tow in both slots of the cleaning rod so that the rod will enter the bore with slight pressure and the advancing tow will fill the grooves. Soak the tow in metal-fouling solution. Cleaning of the bore <sup>of</sup> with a machine gun which is not disassembled is performed from the muzzle end, and with a disassembled machine gun - from the breech end.

The rod with tow is inserted in <sup>the</sup> chamber and moved slowly and smoothly along its entire length 7-10 times forward and back without extending the tip of the rod outside. Then remove the tow and replace ~~it~~ <sup>with</sup> clean ones, also soaked in metal-fouling solution, and once again in the same sequence wipe the bore. After this, carefully clean the rod of powder residue and metal-fouling solution and thoroughly wipe the bore of the barrel and the chamber with a clean dry rag. If traces of deposit are noticed on the rag continue the wiping of the bore with the tow or wiping rag soaked in metal-fouling solution. If the dry wiping rag ~~during wiping~~ comes out of the bore clean without blackening from powder residue, inspect the bore of the barrel from the muzzle to the chamber end in the light, slowly rotating the barrel in the hands. In so doing, pay special attention to the angles of rifling, making sure that no deposit remains in them.

Remarks. 1. Bores of barrels damaged by corrosion must be cleaned especially carefully since powder residue is removed from them with difficulty.

2. A barrel ~~from the bore~~ of which powder deposit will not come off by using the described method is to be sent to the ordnance workshop.

3. If the cleaning rod gets stuck in the bore of the barrel, set the barrel vertical (if it has ~~been~~<sup>EN</sup> removed) or lower the tipping part of the mount as far as it will go (if the machine gun has not been disassembled). Pour a little heated lubricant into the bore and wait a few minutes. ~~After this~~<sup>THEN</sup>, try to remove the cleaning rod. If it will not come out ~~without special force~~<sup>EASILY</sup>, send the barrel to the ordnance workshop.

Carbon on the front edge of the barrel is first softened with metal-fouling solution and then removed by cleansing, with the aid of wooden sticks, cleaning rags or cleaning patches. Clean the carbon off the rear edge of the barrel with wooden sticks and cleaning rags. ~~Having finished cleaning the bore of the barrel, wipe the barrel on the outside.~~ Having finished cleaning the bore of the barrel, wipe the barrel on the outside. ~~The~~ lubricate the bore and the chamber evenly and ~~not thickly~~ with rifle grease. Wipe the barrel outside with a cleaning rag soaked in rifle grease.

The regulator of the gas chamber after prolonged firing is separated from the gas chamber and thoroughly cleaned with cleaner and rag soaked in metal-fouling solution. After cleaning, the regulator is rubbed with ~~the~~<sup>A</sup> rag until quite dry and lightly lubricated with rifle grease.

The gas chamber, after separation from the regulator, is washed with metal-fouling solution and cleaned with cleaner and rag, then rubbed until quite dry and lightly lubricated with rifle grease.

41. The receiver housing is cleaned with dry cleaning rags. Dirt and dripped grease are removed from the grooves. When cleaning is finished, the receiver housing is lightly lubricated with rifle grease.

42. The bolt is cleaned ~~of~~ powder residue with metal-fouling solution, then rubbed until quite dry, and lightly lubricated with rifle grease.

43. The gas piston, before cleaning, is immersed for a while in metal-fouling solution and then thoroughly wiped and lightly lubricated.

44. The bolt support and back plate are cleaned with an oiled cleaning rag, ~~which is~~ <sup>removed</sup> until quite dry, after which they are lightly lubricated with Rifle Grease.

45. The trigger mechanism is not disassembled for cleaning, but wiped with a cleaning rag and lightly lubricated with rifle grease.

46. The receiver is cleaned with cleaning rags and wooden sticks. When severely soiled, the receiver is disassembled, washed in metal-fouling solution, and wiped until quite dry. When cleaning is finished, the moving parts of the receiver are lubricated with rifle grease.

47. The muzzle brake is cleansed of carbon deposit by washing in metal-fouling solution, then wiped until quite dry, and lightly lubricated with rifle grease.

48. The parts of the mount are wiped with a dry cleaning rag; the grooves, openings, and threading are cleaned with wooden sticks and rags, after which they are wiped until quite dry and lubricated with rifle grease.

49. Colored and wooden parts of the machine gun are not lubricated, but are wiped with dry cleaning rags,

50. Lubricant is applied in a thin layer with a rag soaked with rifle grease. During lubrication of openings, the soaked rag is passed right through the opening. For lubricating depressions, grooves, and slots wrap the soaked rag around a wooden stick. The lubricant must <sup>BE APPLIED SPARINGLY</sup> ~~not be too abundant~~; excess lubricant contributes to soiling.

51. When cleaning and lubrication have been finished, the gunner, together with the number two crew member assemble the machine gun and inspect it in assembled form. The section commander checks the correctness of assembly and gives permission to put the machine gun away for storage.

#### RULES FOR STORAGE AND MAINTENANCE OF THE MACHINE GUN UNDER VARIOUS CONDITIONS

52. Responsibility for storage of the machine gun, spare parts, and accessories within the unit rests on the gunner and section commander. The



gunner is required to store and keep the machine gun, the spare parts, and the accessories in working condition, to handle them carefully, and to inspect them daily to be fully sure of their working order and combat readiness.

53. When deployed in barracks or camp, the machine guns are stored in a closed dry place without covers, on racks, the lower shelves of which must be raised above the floor no less than 15-20 cm.

In camps, in the absence of racks, the machine guns are stored on a dirt floor; wooden flooring is placed under the wheels of the machine guns. In the absence of covered places, the machine guns are stored with dry covers put on them.

The spare parts and accessories are stored in bags with the machine gun.

54. Under conditions of barracks and camp deployment, the machine guns are stored in assembled form. The shield is not mounted. The body of the machine gun is set in the horizontal position. The swivel is set in mid position. The bolt-type clip and the fine elevation clamp are not secured. The rough elevation mechanism is clamped lightly. The sight leaf is set on the frame of the back plate. The rear-sight slide is lowered on the leaf as far down as it will go. The actuator spring is released, <sup>DISCONNECTS</sup> for which the guide tube of the piston ~~is disconnected~~ from the barrel.

The spare parts are lightly lubricated with rifle grease (in depot storage - with gun grease), wrapped in clean oiled paper and placed in the bag for accessories.

The cartridge belts are put into boxes.

55. When deployed in a populated area, the machine guns are stored according to items 52 and 53; they are placed in rooms on the floor (on racks) as far away from doors and stoves as possible.

56. During trips by railroad, the machine guns are transported in assembled form with mechanisms secured; they are set on the floor of the railroad car, protected against bumps and shocks.

57. On the march, the machine guns are transported in motor vehicles in the same condition as during railroad trips. In so doing, the machine gun may be mounted for firing on aerial targets,

The machine guns <sup>MUST BE</sup> ~~are~~ reliably secured so that they cannot shift ~~from their~~ ~~places~~ during the ~~time~~ of travel.

58. In order to move the machine guns on wheels by hand it is necessary to:

- set the swivel in mid position and secure it with the base clamp;
- lower the fine elevation mechanism as far as it will go and secure it with the clamp;
- lower the tipping part of the mount and secure it with the rough elevation aiming clamp.

59. When handling the machine gun during time of duty, training, and firing in a combat situation, observe the following rules:

- before going out for training or firing, inspect the machine gun and wipe the outside of the metal parts, freeing them of grease; before firing, wipe the bore; on the march, in combat, and in exercises, protect the machine gun from dust and moisture;
- guard the machine gun from blows with hard objects;
- when checking the operation of parts, loading, and unloading, and clearing stoppages during firing, do not apply extreme force which could lead to damage or breakage of parts;
- lower the receiver or its cover onto the receiver housing carefully;
- do not instruct in loading and unloading the machine gun without using test cartridges;
- in order to prevent muzzle swell and other damage to the barrel, never obstruct the bore with anything, and promptly remove dirt, snow, and so forth, which get into it.

## CHAPTER IV

### FUNCTION AND CONSTRUCTION OF THE PARTS AND MECHANISMS OF THE MACHINE GUN

#### BARREL

60. The barrel (Fig. 10) serves to direct the flight of the bullet in firing. Inside, it has a cartridge chamber for holding the cartridge, and a rifled bore with eight grooves spiraling upward from left to right. The grooves serve to impart a rotational motion to the bullet in flight. The spaces between the grooves are called lands. The distance between two opposite lands (in diameter) is called the caliber of the barrel; the caliber of model 1938 and 1938/46 machine guns equals 12.7 mm.



Fig. 10 Barrel;

- 1- muzzle brake;
- 2- cartridge chamber;
- 3- shaped groove;
- 4- lug;
- 5- recess for extractor;
- 6- recess for feed rib;
- 7- conical adapter;
- 8- gas chamber;
- 9- regulator;
- 10- front sight base

of the guide tube piston.

The following are mounted on the barrel: the muzzle brake, front sight with guard and base, the conical adapter and gas chamber with regulator.

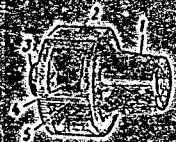
At the muzzle end of the barrel there are the gas port and gas chamber secured by two cotter pins; and on the end of the muzzle - a screwthread for the muzzle brake and the front sight base secured by two pins. On the middle of the ribbed part of the barrel <sup>barrel</sup> underneath, a shaped groove is made for the stop

At the chamber end of the barrel there are: a lug for securing the barrel in the receiver housing; with the aid of a wedge in assembling the machine gun, and a cross cut for admitting the barrel wedge. At the back of the cut, two

recesses are made: the lower one for entry of the extractor, and the upper one for the feed rib.

61. The muzzle brake (Fig.11) serves to reduce the recoil force to increase the stability of the machine gun in firing.

The muzzle brake has a brake tube with internal thread for screwing onto the muzzle end of the barrel, and a brake cap for direct use of the powder gases.



The following are located in the muzzle brake cap:

- in the front wall - a bushing with opening for passage of the bullet and part of the powder gases;

- on the lateral walls - ports for passage of powder gases deflected from the cap of the muzzle brake; the ports have slanted bridges to prevent self-unscrewing of the muzzle brake.

Fig.11 Muzzle brake:

- 1- brake tube with thread;
- 2- cap; 3- bushing with opening for passage of bullet;
- 4- port for passage of powder gases; 5- bridge

62. The front sight together with the sighting notch is used for aiming the machine gun at the target. It has a threaded end for connection with the guard. The center part is made squared for the wrench. The upper end, which is cylindrical, is used for aiming. The threaded part of the sight is threaded back to prevent motion. The sight is prevented from unscrewing by the sight nut which is screwed onto the threaded end of the sight.

The sight guard (Fig.12) protects the sight from shocks. It has two cheeks, a threaded recess for connection with the sight, a lug for connection with the base of the sight, and a bolt with nut. Mounting marks are applied to the walls of the guard.



Fig. 12. Front sight:

1- threaded end; 2- squared part;  
3- cylindrical part; 4- nut



Fig. 13. Sight guard with bolt:

1- cheeks; 2- threaded recess;  
3- lug; 4- mark; 5- bolt with  
nut

The front sight base is mounted on the barrel and secured by two pins. It has two walls with grooves for mounting the sight guard, and an opening which has threading in the front wall for the base bolt. The sight guard is secured on the base with the bolt.

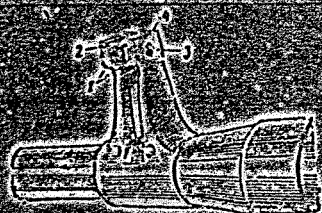


Fig. 14. Front sight base:

1- walls; 2- groove; 3- opening;  
4- scale with markings

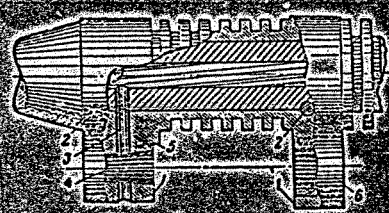


Fig. 15. Gas chamber:

1- cylindrical projections;  
2- openings for pins; 3- ver-  
tical channel; 4- longitudinal  
channel; 5- shoulder; 6- opening  
for guide tube piston

63. The gas chamber (Fig. 15) is used to remove gases and to hold the regulator. It has a channel for mounting on the barrel, and two cylindrical lugs below (front and rear) and two openings for the pins which secure the chamber on the barrel.

The front lug of the chamber has two channels; a vertical one for the passage



of gases to the regulator and a longitudinal one for accommodation of the conical shank of the regulator. In the back part of the front lug on top, there is a shoulder for correct setting of the regulator during assembly, and on the right wall - a mounting mark for correct installation of the regulator.

The rear lug of the chamber has an opening for the piston guide tube.

64. The gas regulator (Fig.16) serves for regulation of the supply of gases to the piston. It consists of a conical shank and a cylindrical part. The regulator is set by its conical shank ~~is set~~ from behind in the longitudinal channel of the front lug of the gas chamber and secured by a nut. The nut is secured by a cotter pin. The regulator has a blind longitudinal channel with three through openings with diameters of 2.8, 3.5, and 4 mm. For convenience in mounting the regulator, the figures 2.8, 3.5, and 4 are inscribed on the faces of the cylindrical part of the regulator.

65. The barrel wedge with nut and washer (Fig.17) is used to fasten the barrel in the receiver housing.

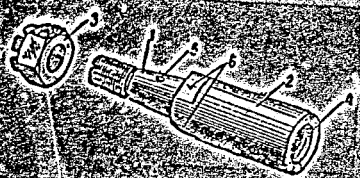


Fig. 16. Gas regulator;  
1- conical shank; 2- cylindrical part;  
3- nut; 4- blind longitudinal channel;  
5- gas port; 6- figures

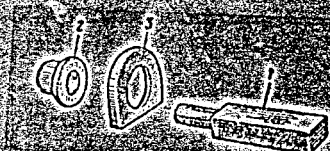


Fig. 17. Barrel wedge;  
1- wedge; 2- nut; 3- washer

#### RECEIVER HOUSING

66. The receiver housing (Fig.18) connects all parts of the machine gun.

In the front part of the receiver housing there is a through channel to accommodate the barrel, a longitudinal groove to admit the barrel lug, and a through cross opening for the barrel wedge. A cross groove is made on top for fastening the antiaircraft sight, and there are also the receiver retainer and holes for connecting the receiver with the receiver housing. A groove is made on the right wall for the washer of the barrel wedge. Two pivots are located on the sides which are used to fasten the machine gun to the mount.

In the middle part of the receiver housing there is an opening for the receiver, and there are the port for passage of the cartridges, the guide pin of the receiver for limiting lateral shifting of the receiver on the receiver housing, and the base of the sight.

The back wall of the opening has a bevel for the ejector stop when the bolt moves backward.

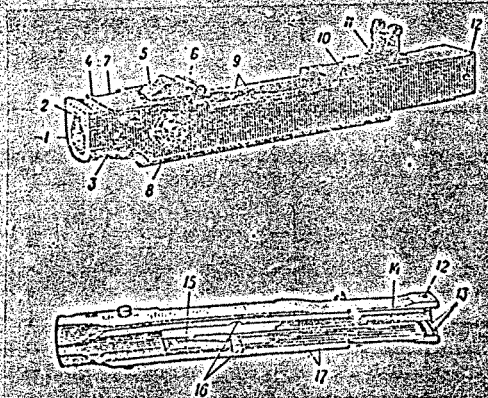


Fig. 18. Receiver housing:

1- through channel for barrel; 2- longitudinal groove for admittance of barrel lug; 3- through cross opening; 4- cross groove for mounting antiaircraft sight; 5- receiver retainer; 6- hole; 7- groove for wedge washer; 8- pivots; 9- opening for receiver; 10- guide pin for receiver; 11- sight base; 12- opening for pin; 13- vertical grooves for connection with back plate; 14- longitudinal grooves for trigger housing lugs; 15- longitudinal grooves for guiding movement of bolt support; 16- actuating lugs; 17- slots

In the back part of the receiver housing there are the through opening of the back plate pin, vertical grooves for connection with the back plate, and longitudinal grooves for the trigger housing lugs.

The lower part of the receiver housing is open; it accomodates the movable system, the trigger housing, and the back plate.

Inside the receiver housing there are: the longitudinal grooves for guiding the movement of the bolt support; slanted grooves forming the actuating lugs for entry of the bolt recoil lugs when closing the bore, and the grooves for collecting excess grease and dirt falling into the receiver housing, which reduces the friction of the bolt when it moves.

#### REAR SIGHT

67. The rear sight together with the front sight <sup>provides</sup> for giving the machine gun the appropriate sight angles when firing at various ranges. It consists of the base of the sight, back-sight leaf, the sight leaf spring; follower, elevating slide, and a motion screw with a knob.

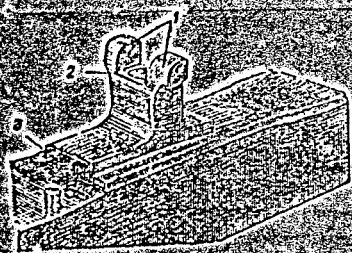


Fig. 19. Rear sight base:  
1- holes; 2- recess for spring and follower; 3- groove for tang of receiver latch

The rear sight base (Fig.19) is screwed by the lower part into the longitudinal groove of the upper wall of the receiver housing and secured by two rivets. The base of the sight has a hole for a hinged connection with the sight leaf, a recess for the spring and sight leaf follower, and a groove for the tang of the receiver latch.



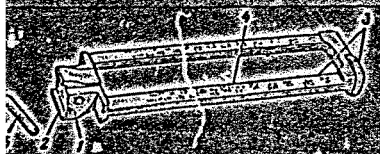


Fig. 20. Rear sight leaf;  
1- stud; 2- limiting lug;  
3- motion screw with knob;  
4- graduations with figures;  
5- pin

The sight leaf (Fig. 20) has:

- a stud with a through opening for connection with the base of the sight with a pin; the lower wall of the stud is a heel for the follower stop of the sight leaf;
- a limiting lug for mounting the sight leaf in a vertical position;
- a groove for the sight leaf motion screw;
- a motion screw with knob for precise setting of the elevating slide on the re-

quired graduation of the leaf;

- graduations with figures (on the right shank, even numbers from 0 to 32, on the left shank, uneven numbers from 0 to 33); the graduations and figures indicate ranges in hundreds of meters.

The rear sight leaf spring (Fig. 21) is cylindrical. It keeps the sight leaf in vertical and horizontal positions. The lower tip of the spring rests in the recess of the sight base, the upper - in the base of the follower.

The follower (Fig. 22) consists of a hollow cylinder with a base. It is installed so that the spring of the sight leaf is compressed between the base of the follower and the base of the recess of the sight base.



Fig. 21. Rear sight leaf  
spring



Fig. 22. Follower

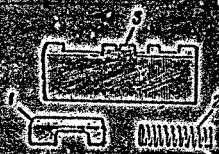


Fig. 23. Elevating slider;  
1- tang; 2- spring;  
3- stationary back sight

The elevating slide (Fig. 23) has a tang with a spring for keeping it on the sight leaf in its assigned position, and a stationary back sight with a notch for aiming.

#### BOLT SUPPORT

68. The bolt support (Fig. 24) connects the movable parts of the machine gun. The bolt support has:

- in the front part - a sliding block for connection with the sleeve, and a longitudinal opening for passage of the cartridge case;
- in the middle part - a transverse opening for the bolt handle;
- in the back part on top - a surface on which the bolt rests on its lower surface, and a post with a cut-out for connection with the striker head; the plane surface has a shaped groove for the lower bolt arm and the lower recoil lugs, and a groove for the front bolt arm;
- in the back part below - a sloped groove along which the sear slides; in the groove, a liner is riveted, the front edge of which forms the sear notch;
- along the sides - longitudinal lugs for the movement of the receiver housing along the longitudinal grooves.

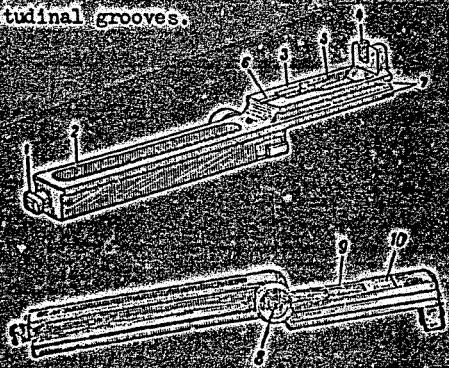


Fig. 24. Bolt support:

- 1- sliding block; 2- longitudinal opening; 3- surface; 4- post with cut-out;  
5- shaped groove; 6- groove for the front bolt lug; 7- longitudinal lugs;  
8- bolt handle; 9- sloped groove; 10- liner

69. The rod with gas piston (Fig. 25) is designed to transmit the effects of part of the powder gases to the bolt support. The rod has:

- on the front end, two annular guide lugs and a gas piston, on the end of which a groove is made;
- in the middle part, four grooves (gravings) to reduce weight;
- on the back end, two transverse grooves for a wrench, and a band thread for connection with the coupling;
- on the back face, a flat for the piston pin.

The return mainspring is placed on the rod.

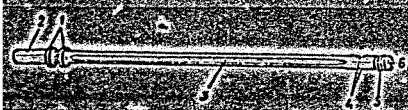


Fig. 25. Rod with gas piston:

- 1- annular guide lugs; 2- gas piston  
3- gravings; 4- two transverse grooves for wrench; 5- band thread; 6- flat for piston pin.

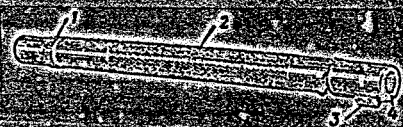


Fig. 26. Piston guide tube:

- 1- annular band; 2- knurling;  
3- stop; 4- annular base

70. The piston guide tube (Fig. 26) is used to accommodate the return mainspring within it, for guiding the movement of the rod with the gas piston, and for protecting them from damage and clogging. The guide tube of the piston has an annular band for a stop in the wall of the back cylindrical lug of the gas chamber, knurling, a stop for connection with the barrel, an annular base as a stop for the back end of the return mainspring.



Fig. 27. Return mainspring

71. The return mainspring (Fig. 27) serves for conveying the movable parts of the machine gun to the extreme forward position.

72. The coupling (Fig. 28) serves for connecting the bolt support with the rod, and for preventing kickback of the bolt support in the forward position.



The coupling has a thread for screwing on the rod, grooves for connection with the bolt support, openings for the pins of the sliding block of the bolt support and gas piston, and a face with notches for the piston pin spring.

## BOLT

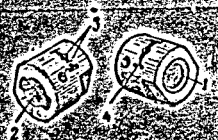


Fig. 28. Coupling:

- 1- thread; 2- groove for connection with bolt support; 3- openings for pins of sliding block and gas piston; 4- face with notches

73. The bolt (Fig.29) serves to send the cartridge into the cartridge chamber, for closing the bore when firing, for producing firing, and for extraction and ejection of the spent cartridge.

The bolt consists of the breech frame, two recoil lugs, a striker, firing pin, extractor, ejector with pins, and an extractor spring.

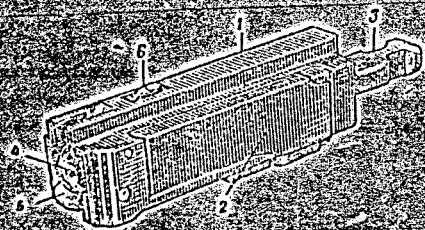


Fig. 29. Bolt:

- 1- breech frame; 2- recoil lug; 3- striker; 4- firing pin; 5- extractor; 6- ejector

The breech frame (Fig.30) is used to connect all the parts of the bolt. It has:

- a seat on the front face for holding the base part of the cartridge and an opening for exit of the firing pin;
- a recess below in the front part for the extractor with its spring, and a front lug which serves as the wall of the channel for the extractor spring;

- below to the rear, a lower lug for connection with the bolt support;
- on top, a sloped channel for the ejector and cam, a front face which is the feed rib for sending the cartridge into the cartridge chamber;

- on the lateral walls, cross openings for the extractor pin, the pins of the ejector; and the firing pin stud.

On both sides of the breech frame there are openings for the recoil lugs and a cut-out for exit of the thickened part of the striker, and inside the breech frame there are two channels for accommodation of the firing pin and striker within them.

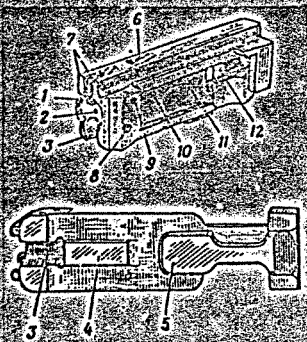


Fig. 30. Breech frame:

1- bolt seat; 2- opening for exit of firing pin; 3- recess for extractor; 4- front lug; 5- lower lug for connection with bolt support; 6- sloped channel for ejector; 7- feed rib; 8- opening for extractor pin; 9- opening for ejector pin; 10- opening for firing pin stud; 11- opening for recoil lug; 12- cut-out for thickened part of striker

Note: The breech frames for machine guns of latest issue are made with a bridge in the upper corner for the back part of the recoil lug. The recoil lugs have corresponding openings.

The striker (Fig. 31) serves for striking the firing pin and extending the recoil lugs.

It has:

- in the back part, a head and lateral cut-outs for connection with the bolt support, and a thickening for extension of the bolt recoil lugs;
- in the front part, cuts for the internal projections of the recoil lugs

The firing pin with stud (Fig. 32) serves to break the primer of the cartridge.



Fig. 31. Striker

1- head; 2- lateral cut-outs;  
3- thickening; 4- cuts



Fig. 32. Firing pin with stud:

1- firing pin; 2- stud

The recoil lugs (Fig. 33) together with the breech frame are designed to close the bore during firing. They are held in the lateral openings of the breech frame. The recoil lugs have protrusions in the back part on the lower part of which the walls of the shaped opening of the frame press and reduce the lugs, and on the interior part, press with their thickened part and open the firing pin stops.



Fig. 33. Recoil lugs:

1- protrusions



Fig. 34. Extractor with spring and pin:

1- extractor; 2- spring; 3- pin

The extractor with spring and pin (Fig. 34) serves to withdraw the case (cartridge) from the cartridge chamber.

The ejector with pin (Fig. 35) ejects the cartridge case outward.



Fig. 35. Ejector with pin:

1- ejector; 2- pin

## TRIGGER HOUSING

74. The trigger housing (Fig.36) is the base for assembly of the parts of the trigger and safety groups, and also for fastening the breech end of the machine gun to the mount.

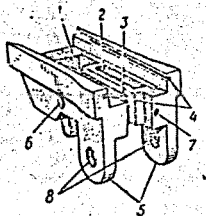


Fig.36. Trigger housing:

1- recess for sear with spring;  
2- recess for safety stop and its spring;  
3- recess for sear lever; 4- longitudinal grooves; 5- hinge lugs; 6- opening for safety; 7- opening for back end of safety stop; 8- hinge lug openings for rear fastening bolt

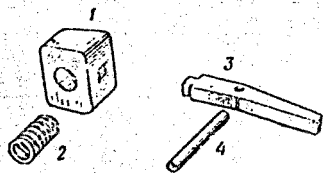


Fig. 37. Trigger group:

1- sear; 2- sear spring; 3- sear lever;  
4- sear lever pin

In the upper part of the trigger housing, there is a longitudinal channel with three recesses: the front one for the sear with spring, the right one for the safety stop and its spring, and the middle one for the sear lever.

Longitudinal grooves are made on the lateral walls of the channel for connection with the receiver housing, and openings for the safety and for the sear lever pin. In the back wall on the right, there is an opening for the back end of the safety stop.

In the lower part of the trigger housing there are two hinge lugs with openings for the rear fastening bolt by which the machine gun is secured to the mount.

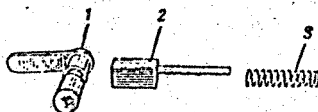


Fig. 38. Safety mechanism:

1- safety; 2- safety stop;  
3- safety stop spring



The trigger group (Fig.37) holds the bolt support and releases it from the sear notch. It consists of a sear with spring and a sear lever with pin.

The safety mechanism (Fig.38) is used to prevent cases of accidental firing. It consists of a safety catch, safety stop, and safety stop spring.

## BACK PLATE

75. The back plate (Fig.39) is the back wall of the receiver housing. It consists of back plate frame, two yokes with four screws, two hand grips with rings, and two cores for the hand grips.

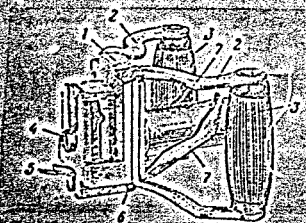


Fig. 39. Back Plate

1- frame; 2- yokes; 3- hand grips;  
4- bolt support buffer; 5- trigger lever;  
6- trigger lever pin; 7- triggers

The bolt support buffer and trigger lever are mounted on the back plate.

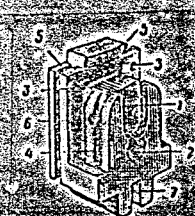


Fig. 40. Back-plate frame

1- recess for striker head;  
2- opening for bolt support buffer;  
3- threaded openings for screws of back-plate yokes; 4- lugs for connecting back plate with receiver housing; 5- grooves for back-plate yokes; 6- through transverse opening for back-plate pin; 7- rectangular groove.

The frame of the back plate (Fig.40) is used for connection with the receiver housing and is the base for assembling of all the parts of the back plate. The frame of the back plate has:

- a recess in front to accommodate the striker head during the recoil of the movable system to the rearmost position, and openings for the bolt support buffer.



- on the lateral surfaces, two lugs each for connecting the back plate with the receiver housing, grooves for the yokes of the back plate, and a through transverse opening for the back-plate pin;
- on the lower surface, a rectangular groove to accommodate the trigger lever, and a hole for securing the lever to the back plate;
- on the back wall, four threaded openings for the screws of the yokes of the back plate, and a threaded opening for screwing in the tube of the buffer.



Fig. 41. Bolt support buffer:

- 1- bolt support buffer; 2- buffer spring tube; 3- buffer spring;
- 4- buffer tube pin

The back-plate handles are used to control the machine gun during firing. Each handle consists of a wooden grip, two rings, and a core of the grip.

The bolt-support buffer (Fig. 41) serves to dampen the shock of the bolt support in recoil. It consists of a buffer, a buffer spring, a buffer tube, and a buffer tube pin.

The trigger lever is designed to turn the sear lever. It is located in the rectangular groove of the frame of the back plate and has an opening for securing it with the frame of the back plate with a pin and two triggers for the gunner to put his fingers on when firing.

#### RECEIVER

The receiver (Fig. 42) is used to feed the next cartridge into the receiver opening in the base of the receiver. It consists of the receiver base with cartridge depressor, link lifter, and lower pawls; a feed block cover with base; slide with upper pawls and spring; a slide lever with pin, and the bolt support lever with pin and locking mechanism.

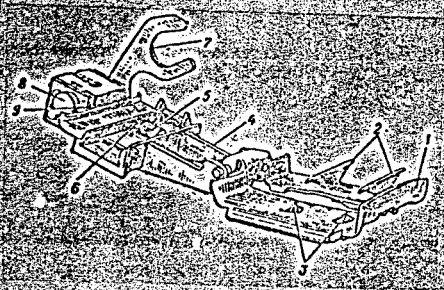


Fig. 42. Receiver:

- 1- base; 2- link lifter; 3- lower pawls; 4- cover; 5- slide with upper feed pawls; 6- slide lever; 7- bolt support lever; 8- bolt support lever pin; 9- locking mechanism

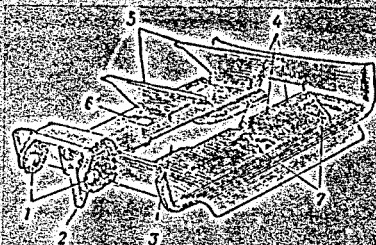


Fig. 43. Receiver base:

- 1- hinge lugs; 2- cartridge depressor; 3- receiver opening; 4- opening for link lifter; 5- link lifter; 6- cut-outs with holes for lower pawl pins; 7- lower pawls

The receiver base (Fig. 43) has:

- hinge lugs for connection with the receiver housing;
  - a cut-out to accommodate the cartridge depressor, and two openings for rivets securing it to the receiver base;
  - a receiver opening into which the next cartridge is fed before it is fed directly into the cartridge chamber;
  - six symmetrically arranged openings for the screws of the link lifter;
  - four symmetrical cut-outs with holes for the pins of the lower pawls;
- a spring is put on the pin to keep the pawls in the upper position.

The feed block cover (Fig. 44) has:

- hinge lugs for connection with the receiver housing;
- a cut-out for the spring catch holding the receiver in the vertical position, and three openings for the rivets of the catch;
- a cut-out to accommodate the base;
- two openings on top in the middle part for passage of the base screws, and an opening at the back for the slide lever pin; shank;

- on the side walls in the back part, rectangular openings for the head of the slide lever, and three openings each for the screws of the base, the pin of the support lever, and the locking mechanism.

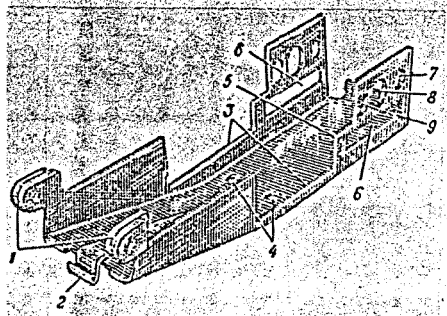


Fig. 44. Feed block cover:

- hinge lugs; 2- spring catch;
- cut-out for base; 4- openings for base screws; 5- opening for shank of slide pin; 6- rectangular opening for head of slide lever; 7- opening for base screw; 8- opening for locking mechanism

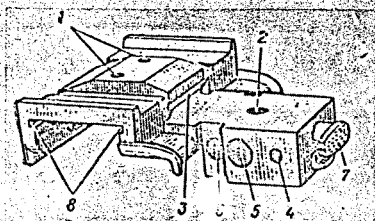


Fig. 45. Base of feed block cover:

- 1- openings for screws; 2- recess for head of slide lever pin; 3- longitudinal groove; 4- opening for base screw; 5- opening for bolt support lever pin; 6- opening for locking mechanism; 8- cross grooves for slide

The base of the feed block cover (Fig.45) serves as a base for assembling the slide, slide lever, locking mechanism, and the bolt support lever pin. It has:

- on the upper surface, two threaded openings for the base screws, a recess for the head of the slide lever pin, and a longitudinal groove for the receiver slide lever;
- on the side walls, threaded openings for the screws of the base, two through openings for the bolt support lever pin, and to accommodate the locking mechanism;
- on the back wall, a catch with tooth and spring;
- on the lower surface, an oval opening for the guide pin of the receiver;
- cross grooves inside for the slide of the receiver.

The slide with upper pawls (Fig.46) feeds the bolt with cartridges into the receiver opening of the base of the receiver. The slide has a bend for the shank of receiver lever and a post with hinge lugs for securing the upper pawls with a pin,

and a spring which ensures engagement of the upper pawls behind the next cartridge

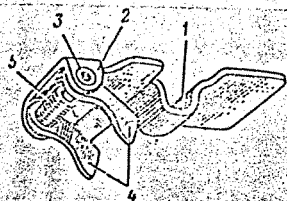


Fig. 46. Slide with upper pawls:

1- bend; 2- hinge lug; 3- pin;

4- upper pawls; 5- spring

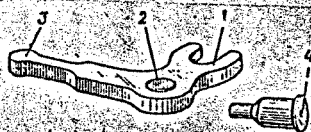


Fig. 47. Receiver slide lever

with pin: 1- head with fork;

2- opening for pin; 3-shank; 4-

The receiver slide lever with pin (Fig.47) has a head with fork for connection with the lug of the bolt support lever or its pin with left-hand feed of the receiver, and an opening for the pin of the lever, and a shank for for entry into the slide of the receiver.

The bolt support lever with pin (Fig.48) has a fork for the bolt support lever, a rectangular opening for the pin, an opening for entry of the latch of the locking mechanism of the support lever, a lug for connection with the fork of the slide lever, a pin with two washers, a nut and pin for connection of the lever with the feed box cover.

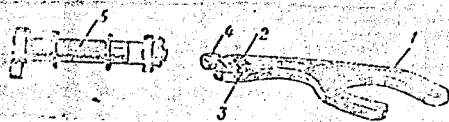


Fig. 48. Bolt support lever with pin:

1- fork; 2- rectangular opening for pin;

3- opening for entry of locking mechanism

catch; 4- lug; 5- pin with two washers, nut, and pin

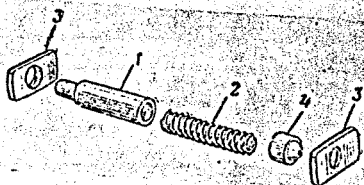


Fig.49. Locking mechanism:

1- latch; 2- spring; 3- plate;

4- stop

The locking mechanism (Fig.49) serves to keep the support lever in the forward position. It consists of a latch, spring, two plates, and a stop.

#### KOLESNIKOV UNIVERSAL MOUNT, MODEL 1938

77. The mount (Fig. 50) gives the machine gun stability during firing on ground and aerial targets and is used to transport the machine gun over short distances.

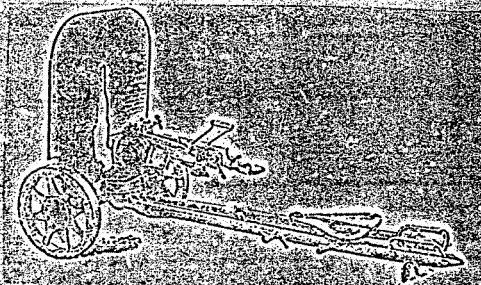


Fig. 50. General view of Kolesnikov mount, model 1938

In order to fire on aerial targets, the mount is set on a tripod which provides for all-around fire ( $360^\circ$  rotation of the machine gun in the horizontal plane) and the ability to give the machine gun angles of elevation of  $78-80^\circ$ .

#### CONSTRUCTION OF THE MOUNT

78. The mount consists of the following parts: the mount base with legs and collar, swivel, tipping part with fine elevation mechanism, and a charging handle, mount carriage, shield, and shoulder piece.

#### MOUNT BASE WITH LEGS

79. The mount base with legs (Fig.51) is the basis of the mount. It con-



-sists of the mount base with carriage lock, rear leg with seat- arm rest, front legs (left and right), a stop and lock for the front legs, and the base collar.

The base of the mount has:

- a lug in the front part with cross groove for fastening the carriage to the base with the carriage lock;
- two lugs on the lower surface for articulated connection of the front legs to the base with openings for their pins;
- a lug in the central part for articulated connection of the rear leg with an opening for its pin; two conical openings on the crest of this lug for passage of the rear leg clamp spindle;
- an annular lug on the upper surface, the outer surface of which is chamfered for setting the base with the collar, and a swivel for assembly.

The carriage lock is used to secure the carriage to the mount base. It consists of a swing-away coupling, a locking nut and locking lever.

The rear leg has:

- a hinge consisting of two parallel pieces with through openings for the hinge pin which is secured by a nut, and an opening for the leg stop;
- an opening for the front leg lock;
- a key to limit turning of the base of the seat, and a handhold;
- a spade, the plate of which has flanges to limit lateral shifting of the front legs.

The seat-arm rest is used as a seat when firing the machine gun seated and as an arm rest when firing lying down. It consists of two parts, hinge-connected to one another and with the seat base. The base is fastened to the rear leg and has a split tube for tightening the collar of the tightening bolt.

The front legs (each of them) have a hinge with a through opening for the pin, the threaded end of which screws into the hinge piece, and a tip with a stop.

The stop of the rear leg secures the leg in the ground or antiaircraft position of the mount. It consists of a tapered stop, a stop lever, and a lever pin.

The tapered stop has a cut-out for passage of the stop under the base lug, a dog lug to limit the shifting of the stop in the hinge of the rear leg, and threading for screwing into the left piece of the hinge of the rear leg.

The front leg lock consists of the lock frame, a lock lever, and pin. The frame of the lock has two lateral lugs for pressing the ends of the front legs against the trail. In the lower part of the lock lever there is a lug, with which, the lock lever, dropping down, raises up the front shoulder of the lock frame and drops the back end of the lock frame down.

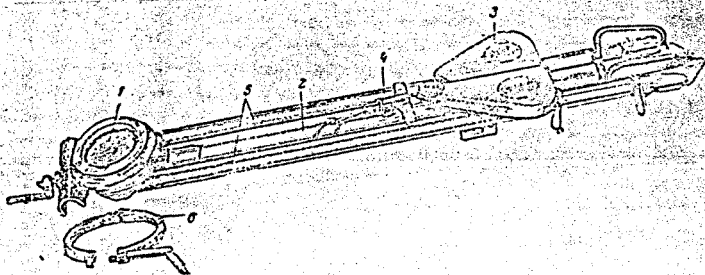


Fig. 51. Mount base:

- base with carriage lock; 2- rear leg; 3- seat-arm rest; 4- stop with front leg lock; 5- front legs; 6- base collar

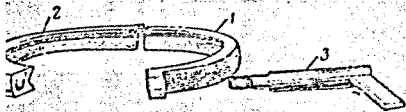


Fig. 52. Base collar:

- right part of collar; 2- left part of collar; 3- tightening bolt of collar with horizontal clamp lever

The base collar (Fig. 52) serves to connect the swivel with the base, and for securing the traverse of the machine gun. It consists of the right and left parts of the collar, the pin, and tightening bolt with lever. The back ends of the right and left parts of the collar have holes for the tightening bolt, the left hole is threaded.

## -SWIVEL

80. The swivel (Fig. 53) serves for traversing the machine gun and for firing traversing fire. It consists of a disk and right and left brackets.

The brackets have:

- lugs in front with vertical grooves for mounting the shield; there are recesses in the lugs for the shield fasteners with handles;

- on the rear ends, openings for passage of the pins of the tipping-part of the mount.

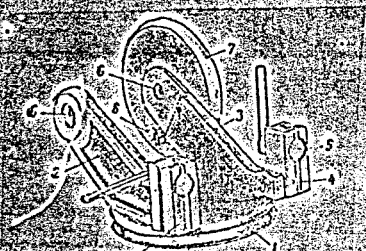


Fig. 53. Swivel:

1- disk; 2- right bracket; 3- left bracket; 4- lugs with vertical grooves; 5- shield fasteners; 6- openings for pins of tipping part; 7- disk lug; 8- stop

The left bracket of the swivel has a disk lug for mounting the vertical clamp collar of the mount. There is a stop on the disk lug which limits movement of the tipping part in the vertical plane.

## TIPPING PART OF THE MOUNT

81. The tipping part of the mount (Fig. 54) serves to secure the machine gun to the mount and for elevating the machine gun. It consists of the traversing base lower tipping base with charging handle, and upper tipping part.

The elevating base (Fig. 55) serves for securing the fine aiming mechanism, for keeping all the tipping parts of the mount at the required angle, and for attaching the ammunition box to the mount. The elevating base consists of the base frame, the rough elevation clamp, the fine aiming mechanism, and the fine elevation clamp.



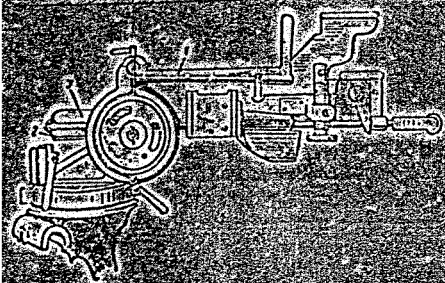


Fig. 54. Tipping part of mount:

- elevating base; 2- lower tipping base; 3- upper tipping base



Fig. 56. Rough elevation clamp:

- linkage rod; 2- bushing;
- clamp nut with lever

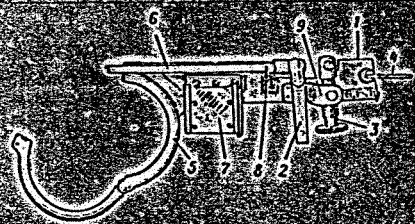


Fig. 55. Elevating base:

- 1- base frame; 2- rough elevation clamp; 3- fine aiming mechanism; 4- fine elevation clamp; 5- collar; 6- base linkage; 7- ammunition box bracket; 8- lug with opening; 9- fine elevation mechanism bracket

The base frame has:

- in the front part, a collar consisting of two clamps; the back part of the collar comprises a single unit with the elevating base, the front part of the collar is connected from below with the base pin, and on top, with the base linkage rod;
- in the middle part, the ammunition box bracket with catch, a lug with an opening for passage of the linkage rod, and the fine aiming mechanism bracket;
- in the back part, an opening for passage of the screw of the fine aiming clamp.

The rough elevation clamp (Fig. 56) consists of a linkage rod, bushing, and clamp nut with lever.

The linkage rod of the clamp has an opening for the pin connecting the linkage rod with the front part of the collar, and the threaded end of the clamp nut.

The fine aiming mechanism is used for precise elevation of the machine gun when firing. It consists of the elevating screw, elevating nut, cap, pins, knob, and cotter pin.

The fine aiming clamp consists of the bolt, nut, and lever.

The lower tipping base (Fig. 57) serves as a base for mounting the tipping part of the mount.

The lower tipping base has:

- grooves for connection with the upper base and for directing its movement in recoil and counterrecoil;
- a cylindrical recess for the bolt and spring of the buffer;
- a bracket, the back end of which serves for securing the machine gun to the mount with the aid of a slide with openings, and a threaded pin of the rear fastening with lever.

The bracket has:

- a spring retainer for holding the charging handle in the forward position;
- a cartridge case outlet for directing the ejected cartridge;
- a large vertical lug for fastening the shoulder piece to the mount
- a pin for connection with the fine aiming mechanism;
- an inclined groove for the head of the fine aiming clamp bolt;

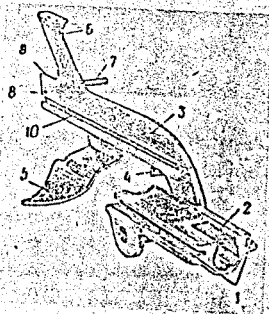


Fig. 57. Lower tipping base:  
1- grooves; 2- cylindrical recess;  
3- bracket; 4- spring retainer;  
5- cartridge case outlet; 6- large vertical lug; 7- pin for connection with fine aiming mechanism;  
8- opening for slide limiting bolt;  
9- guide lug for moving of slide;  
10- longitudinal guide groove

- a threaded opening for the slide limiting bolt;
- the guide lug for the slide;
- a longitudinal guide groove for the lug of the charging handle.

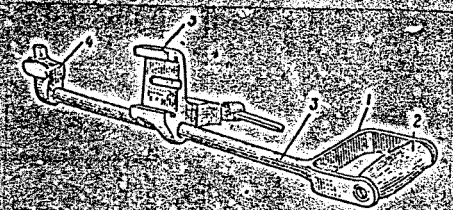


Fig. 58. Charging handle:

- 1- yoke; 2- wooden grip; 3- rod;
- 4- hook with guide lug; 5- slide

The charging handle (Fig. 58) serves for drawing the movable system backward (by hand). It consists of a yoke with wooden grip, rod and slide. The rod has a hook on the front end with a guide lug. The hook is connected with the rod by a p.

The upper tipping base (Fig. 59) serves as the front fastening of the machine gun. It has:

- a cylindrical lug, on the back surface of which, the buffer spring rests;
- two brackets with trunnion beds for the trunnion of the receiver housing, and openings for the cap pins, and lugs on the lateral surfaces for hinged fastening of the tightening bolt.

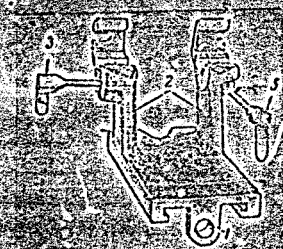


Fig. 59. Upper tipping base:

- 1- cylindrical lug; 2- brackets;
- 3- tightening bolts

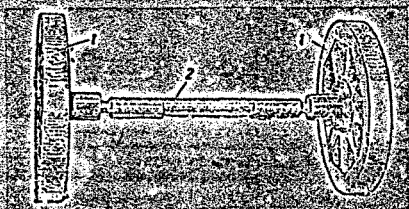


Fig. 60. Mount carriage:

- 1- wheels; 2- axle

## MOUNT CARRIAGE

82. The mount carriage (Fig.60) serves for manual transport of the machine gun. It consists of two wheels (rollers), the carriage axle of the mount, and two removable nuts with pins.

## MOUNT SHIELD

83. The mount shield (Fig.61) has rectangular cut-outs for the wheels of the carriage, a shaped cut-out for passage of the body of the machine gun and for aiming, and two brackets for fastening to the mount.

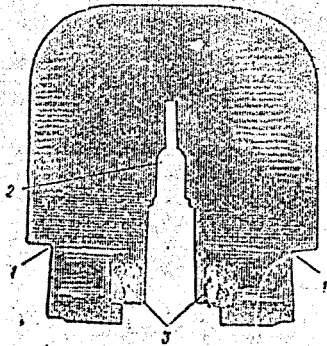


Fig. 61. Mount shield:

1- rectangular cut-outs; 2- shaped cut-out;  
3- brackets

## SHOULDER PIECE

84. The shoulder piece (Fig.62) is used for convenience in controlling the machine gun during firing on aerial targets. It consists of the base of the shoulder piece, a tube with a fork, the tube catch, a right shoulder support with socket, a left shoulder support, a base clamp, gear sector, two clamp

couplings, and a base catch.

The base of the shoulder piece has a longitudinal groove for securing the shoulder piece to the mount, and an opening for articulated connection of the gear sector to the mount.

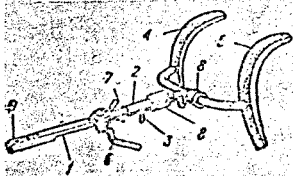


Fig. 62. Shoulder piece:

1- base; 2- tube with fork; 3- tube catch;  
4- right shoulder support; 5- left shoulder support;  
6- base clamp; 7- gear sector;  
8- clamp coupling; 9- base catch

The tube has a fork for articulated connection with the gear sector of the shoulder piece, and a cut-out for the tube catch.

Inside the tube there is the tube catch with spring for holding the shoulder piece in the position assigned to it. The base socket is mounted on the back end of the tube.

The base socket has a coupling which secures it to

the tube. The arm of the right shoulder support is welded onto the socket. Movement of the socket of the base in the tube of the shoulder piece is regulated according to the height of the gunner.

The arm of the right shoulder support has a split end with threading, inside of which the end of the left shoulder support arm is placed and connected by the coupling. This is used to regulate the distance between the shoulder supports to correspond to the width of the gunner's shoulders.

The base clamp serves to keep the shoulder piece in the horizontal plane in the position assigned to it.

It is necessary to turn the clamp lever clockwise to release the base clamp. The couplings are first tightened by hand and then tightened down with a wrench.



## METALLIC BELT AND BOX FOR IT

85. The metallic belts (Fig.63), having 50 links articulating with each other, are loaded with cartridges.

Each link of the belt is equipped with two pairs of spring horns for keeping the cartridge from falling out, and a stop to give the cartridge the correct position in the belt.

86. The loaded belt is put in a metal box accordion style. The box is fastened to the mount bracket.

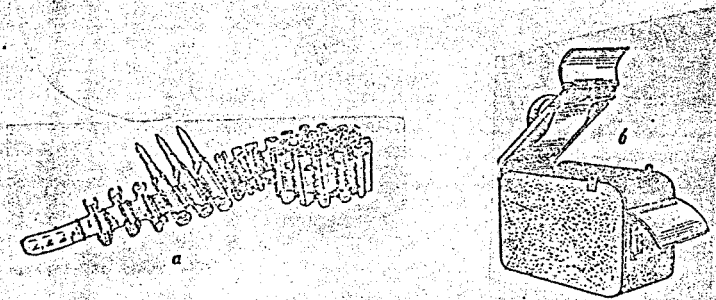


Fig. 63. Belt and box for it: a - belt; b- box

## ACCESSORIES FOR THE MACHINE GUN

87. Each machine gun is assigned accessories (Fig.64) for disassembly, assembly, cleaning, and for other requirements in regard to maintenance of the machine gun and its care. The accessories must always be serviceable and be located with the machine gun.

The list of accessories includes:

- jointed cleaning rod for cleaning and lubrication of the bore, with three sections, a handle, and tip;
- bent rod with brush for lubricating the cartridge chamber and moving parts;

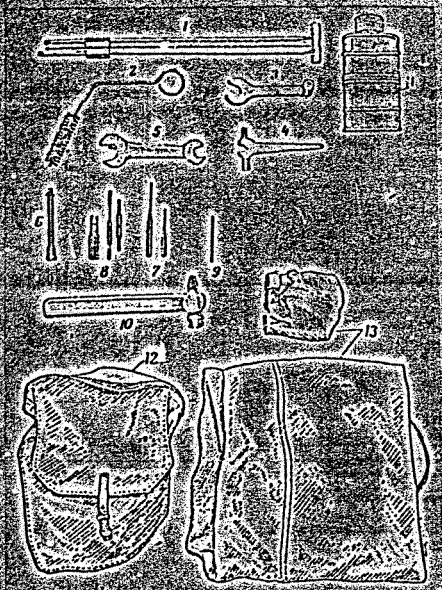


Fig. 64. Accessories:

- 1- jointed cleaning rod; 2- bent rod with brush;
- 3- wrench for gas chambers and barrel wedge;
- 4- wrench-screwdriver; 5- mount wrench; 6- extractor;
- 7- punches; 8- scourers; 9- twist; 10- machinist's hammer;
- 11- container for lubricant; 12- bag for accessories;
- 13- machine gun cover

- wrench for the gas chamber regulator and barrel wedge with a cut-out for tightening (releasing) the regulator nut and screwing on (unscrewing) the buffer tube of the bolt support and recess for the nuts of the barrel wedge and receiver pin;
- wrench-screwdriver with four-sided socket for installing the front elevation sight, and a hexagonal socket for the front sight nut and the front sight base bolt nut, a slot for the rod of the gas piston and nut of the bolt support lever pin, and a screwdriver for screws;
- extractor for removing torn-off parts of cartridge cases from the cartridge chamber;
- punches, large and small, for knocking out cotter pins, pins, and studs in disassembling the machine gun;
- scourers for removal of powder residue from the gas tracts of the machine gun: a scourer with twist f- for the gas chamber and gas regulator; large and small scourers with twist - for the gas regulator;
- machinist's hammer;
- wooden hammer;
- container for lubricant;
- wrench for mount.

The accessories for the machine gun are stored in a canvas bag.



## CHAPTER V

### INTERWORKING OF PARTS AND MECHANISMS OF THE MACHINE GUN

#### POSITION OF PARTS AND MECHANISMS OF MACHINE GUN BEFORE CHARGING

88. The parts and mechanisms of the machine gun are found in the following positions before charging:

a) The bolt support together with the bolt is in the extreme forward position. In this case:

- the main actuating spring rests by its front end in the annular lug of the gas piston, and by its back end- in the base of the guide tube of the piston and is in a state of reduced compression;
- the piston, by its front part, enters the channel of the gas regulator;
- the bolt support rests its post in the back part of the bolt;
- the recoil lugs of the bolt by the thickened part of the striker are spread aside, their front ends resting against the bolt, and the rear ones- in the recoil lugs of the receiver housing; the barrel is locked reliably; the striker presses on the firing pin with its front part, the end of the pin goes through the opening of the seat of the bolt frame.

b) The ejector is in the forward position.

c) The extractor, under the action of the spring, turns on the pin and occupies the upper position.

d) The front end of the sear lever and sear, under the action of the sear spring are lifted up.

e) The trigger lever with trigger, lifted up by the sear lever, turns forward on the pin.

f) The receiver of the machine gun is free of cartridges and closed on the sear. The support lever is held by the stop. The upper pawls, together with the slide, are in the extreme left position.

#### OPERATION OF PARTS AND MECHANISMS OF THE MACHINE GUN IN CHARGING

89. Charging of the machine gun is performed in the following sequence:

- set the safety in the "Fire" position;
- feed the first cartridge of the loaded belt into the receiver so that it goes behind the feed pawls of the slide;
- forcefully retract the movable parts by the handle until the sear notch of the bolt support sets on the sear; push the charging handle forward.

Note: The movable system can also be retracted with the aid of a cartridge case or cartridge set in the bolt support lever.

90. When retracting the charging handle (or bolt support lever):

- a) The gas piston exits by its front end from the regulator of the gas chamber and compresses the main return spring, the back end of which is pressed into the base of the piston guide tube.
- b) The bolt support retracts the striker; the thickened part of the striker, moving backward, frees the recoil lugs.
- c) The recoil lugs of the support, under the action of the guides of the shaped groove of the bolt support, are brought together, come out of the recoil lugs of the receiver housing, and enter the openings of the breech frame; the bolt is separated from the receiver housing.
- d) The bolt support, continuing to move backward, with its lever, enters the fork of the receiver lever and retracts it.

During retraction of the lever, its pin rotates; the pin of the lever, by its lug, turns the slide lever around its axis. The front end of the lever sends the slide to the right. In so doing, the upper pawls of the slide feed a cartridge into the opening of the receiver base. The next cartridge, passing the lower pawls, is placed in the initial position prior to its subsequent feed into the receiver opening.

e) The retracting bolt support, by its lower surface, depresses the sear until the face of the bolt support liner passes the sear, and the bolt support rests against the buffer. The released sear, under the action of its spring, is lifted up. With the return of the movable system to the forward position, the bolt support is pressed by its sear notch and is held in this position.

f) The cartridge, fed into the receiver opening of the receiver base, stops under the depressor in front of the feed rib of the bolt. The lower pawls hold the belt with the next cartridge from dropping out of the receiver.

The link lifter, by its posts, keeps the belt from misalignment during its feed by the upper pawls and in removing the cartridge from the belt link.

The machine is ready for firing.

#### OPERATION OF PARTS AND MECHANISMS OF THE MACHINE GUN DURING FIRING

91. In order to fire a round, it is necessary to grasp the handles of the back plate with both hands and with the index fingers squeeze the triggers. In so doing:

a) The trigger lever, rotating on the pin, with its forward part presses from below on the back end of the sear lever. The sear lever, rotating on the pin, with its forward end countersinks the sear, in so doing, freeing the sear notch of the bolt support

b) The bolt support, together with the striker, runs forward under the action of the main return spring.

c) The thickened part of the striker, resting in the projections of the recoil lugs of the bolt, causes the bolt to move.

d) The bolt support, continuing to move forward, with its lever turns the lever of the receiver together with its pin. The lug on the pin rotates the slide lever and shifts the slide to the left. The upper pawls of the slide jumps over the next cartridge and occupies the initial position for feeding a cartridge into the receiver opening of the base of the receiver (with the recoil of the moving parts to the rear position).

e) The bolt, moving ~~with~~ forward with the bolt support, encounters the cartridge in the receiver opening of the base of the receiver and sends it into the cartridge chamber with its rib.

f) With the return of the moving parts into the forward position, the bolt stop holds the support lever, preventing its deflection.

g) The ejector, under the action of the cartridge base, is pressed into the extreme forward position; the back part of it goes behind the upper surface of the feed rib of the bolt.

h) The extractor at the <sup>COMPLETION</sup> end of seating the cartridge in the cartridge chamber, with its hook, engages the groove of the cartridge.

i) With further forward movement of the bolt support, the striker goes deeper into the channel of the bolt frame, and with its thickened part, spreads the recoil lugs of the bolt.

j) The recoil lugs of the bolt enter the shoulders of the receiver housing, whereby solid closure of the bore by the bolt is ensured.

k) In approaching the forward position, the bolt support strikes the coupling; the coupling, connecting with the rod, is carried forward by inertia, imparts motion to the guide tube of the piston and in so doing, compresses the main return spring. Thus, the bolt support is kept from recoiling when its post is struck on the back end of the bolt.

l) After this, as closure of the bore is produced by the bolt, the bolt support with the striker continues to move forward until the post of the support rests against the back part of the bolt, and the striker sends the firing pin through the opening of the cartridge seat. This leads to breaking of the cartridge primer, and firing occurs.

92. The bullet moves forward under the pressure of the powder gases. When the bullet passes the gas ports of the barrel, part of the powder gases, following the bullet, rush through the gas port of the barrel into the gas chamber. Through the opening of the regulator, the gases strike on the base of the gas piston and thrust it backward together with the bolt support. The main return spring is compressed.

In so doing:

a) With the beginning of backward movement of the bolt support, the bolt remains in place. Until the bullet shoots out of the bore, it continues to keep the bore closed, not allowing the gases to break through into the receiver housing. During the time the bullet moves through the bore and at the moment it shoots out, the pressure of the powder gases is transmitted through the cartridge case to the bolt, the recoil lugs, the receiver housing, and also to the mount. Recoil occurs which is partially absorbed by buffer of the mount and the muzzle brake.

b) The striker begins movement backward simultaneously with the bolt support. Its thickened part exits from under the projections of the recoil lugs.

c) With further backward movement of the bolt support, the recoil lugs, under the action of the bevels of the shaped openings of the support, are brought together, exit from the recoil lugs of the receiver housing and release the bolt. The bolt, together with the bolt support, recoil.

d) With the recoil of the bolt, the extractor hook withdraws the cartridge case from the cartridge chamber and holds it until encountering the ejector.

e) The ejector, with its upper part, strikes against the bevel of the receiver housing. It moves forward, bears against the cartridge base and throws the cartridge case down through the lower opening in the bolt support.

The rest of the operation of the parts and mechanisms of the machine gun takes place just as with the retraction of the charging handle (the bolt support lever) manually. Recoil of the movable system is limited by the bolt support striking against the buffer. Since the trigger levers are squeezed and the sear depressed, the bolt support does not remain on the sear notch, but returns to the forward position. In so doing, recharging of the machine gun takes place and a new shot is fired.

Automatic fire continues as long as the triggers are squeezed and there are cartridges in the belt.

#### POSITION OF THE PARTS AND MECHANISMS OF THE MACHINE GUN AFTER A TEMPORARY FIRE HALT AND DURING UNLOADING

93. It is necessary to release the trigger levers for a temporary fire halt. In so doing:

a) With the release of the trigger levers, the back end of the sear lever drops. Under the action of its spring, the sear is lifted up. The bolt support, returning forward, rests with its sear notch against the sear and is held in the rear position.

b) Firing is halted. The machine gun remains charged.

94. Unloading the machine gun is performed in the following manner:

a) Set the movable system on the safety in the "Stop" position.

b) With the right thumb, press on the receiver sear. Raise the cover of the receiver upward until it engages with the catch.

c) Withdraw the remaining cartridge from under the posts of the link lifter.

d) After making sure that no cartridge remains in the cartridge chamber, lower the cover of the receiver into place.

e) Set the safety in the "Fire" position.

f) Squeeze the trigger levers; in so doing, the released movable system, under the action of the main return spring, occupies the forward position.

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## CHAPTER VI

### DISRUPTION OF NORMAL OPERATION OF MACHINE GUN MECHANISMS

#### GENERAL MEASURES TO PREVENT AND ELIMINATE STOPPAGES DURING FIRING

95. A well manufactured machine gun with correct handling, attentive maintenance and care is a reliable and non-malfunctioning weapon.

But in the event of soiling of parts and mechanisms, defects in the belt and cartridges, incorrect and careless handling, and also inattentive and insufficient maintenance, malfunctions may appear in the machine gun, disrupting its normal operation and causing stoppages during firing.

96. In order to prevent stoppages during firing and to insure operation of the machine gun without failure, it is necessary to:

- rigidly observe the rules for maintenance of the machine gun and its care, disassembly, inspection, cleaning, lubrication, and assembly, and the rules for preparing the machine gun, the belt, and the ammunition for firing;
- guard the parts and mechanisms of the machine gun against clogging (with sand, dust, dirt) and against shocks;
- during breaks in firing, periodically check the condition of the parts and mechanisms of the machine gun, remove thickened grease and dirt, and also lubricate all moving parts;
- during prolonged conduct of fire, if the situation permits, periodically clean the gas ports of the barrel, chamber, and regulator, clean the carbon off the gas piston and wipe the barrel and cartridge chamber with tow( rags) soaked with metal-fouling solution;
- in the event of overheating of the barrel during intensive fire, and also in the event of appearance of significant defects in the barrel, replace the barrel, following the instructions in item 30;
- during prolonged firing, firing at low temperatures, and also in the

event of frequently repeated stoppages connected with the operation of the gas regulator, set it on the next gas opening, following the instructions in item 31;

- on the march, and also outside of a combat situation, cover the machine gun with the cover;

- the accessories and spare parts are to be constantly kept in bags with the machine gun, clean and lubricated;

- the belts loaded with live cartridges are to be constantly kept in the boxes, clean and serviceable.

97. When handling the machine gun, checking the operation of its parts and mechanisms, and also when eliminating stoppages during firing, do not use excessive force which could lead to damage or breakage of its parts.

98. ~~It is necessary to attempt to~~ eliminate a stoppage occurring during firing by simple recharging. If the stoppage is not eliminated in this way or after elimination it is again repeated, unload the machine gun, <sup>and</sup> determine the cause of the stoppage, and eliminate it.



# TYPICAL MALFUNCTIONS CAUSING STOPPAGE DURING FIRING

Sequence No.	Description of Stoppage	Cause of Stoppage	Means of Elimination of Stoppage
1	2	3	4
1	<p><u>Misalignment or sticking of cartridge in receiver opening of receiver base.</u></p> <p>During recoil the movable system stops (at the moment of engagement of the bolt support lever with the receiver lever) in the forward position.</p>	<p>Non-retraction of movable system as a result of:</p> <p>a) breakage or weakening of belt link horns</p> <p>b) incorrect loading of belt with cartridges</p> <p>c) cartridge pull-down</p>	<p>Draw movable system backward and continue firing. If stoppage repeats, open receiver cover or receiver as a whole and remove cartridge.</p> <p>If stoppage is not eliminated, it is necessary to:</p> <p>1) do not put cartridge into link with weakened horns and at end of firing (during break) remove malfunctioning link or put in serviceable belt;</p> <p>2) check and, if necessary, correct position of cartridges in belt;</p> <p>3) remove useless cartridges.</p>
2	<p><u>Non-feed of belt with cartridges.</u></p> <p>Movable system and bolt support lever stop in recoil (at moment of engagement of bolt support lever with receiver lever) in mid position.</p>	<p>Non-recoil of movable system as result of:</p> <p>a) thick grease and soiling of parts in contact or clogging of gas tracts;</p>	<p>Recharge machine gun.</p> <p>If stoppage repeats:</p> <p>1) wipe and lubricate parts in contact; clean carbon from gas tracts;</p> <p>2) check co-rectness of cartridge loading of bolt and, if necessary, correct;</p> <p>3) remove remaining pieces of belt links from receiver!</p>

Sequence No.	Description of Stoppage	Cause of Stoppage	Means of Elimination of Stoppage
2 cont.		b) Incorrect loading and drop of cartridge from belt; c) break or dropout of connecting hinge of belt link.	4) change belt; if time permits, remove unserviceable links and connect ends of belt.
3	<u>Failure of movable parts to reach extreme forward position.</u> Movable parts and bolt support lever stop during forward movement in intermediate position (close to forward position)	1. Presence of thick grease or dirt on parts in contact. 2. Presence of heavy layer of carbon in gas regulator channel. 3. Clogging or breakage of main return spring.	Draw movable system backward and continue firing. If stoppage repeats, open receiver and wipe and lubricate parts in contact through opening in receiver housing. If stoppage is not eliminated: 1) wipe and lubricate parts in contact; 2) clean carbon and clear clogging from gas regulator (under piston); 3) inspect main return springs; if dirty, clean, replace if broken or send machine gun to workshop.

Sequence No.	Description of Stoppage	Cause of Stoppage	Means of Elimination of Stoppage
1	2	3	4
4	<p><u>Cross rupture of cartridge case.</u></p> <p>Movable system and bolt support lever do not reach extreme forward position, since next cartridge did not enter cartridge chamber and is resting on front part of casing remaining there.</p>	<p>1. Fouling of cartridge chamber or cartridge.</p> <p>2. Poor quality metal of cartridge case.</p>	<p>Forcefully retract movable system behind lever.</p> <p>In so doing, if cartridge case neck is not extracted by next cartridge:</p> <ol style="list-style-type: none"> <li>1) set safety in "Stop" position;</li> <li>2) open receiver;</li> <li>3) place extractor in bolt and advance movable parts as far as they will go, after which, retract them, remove extractor from bolt, and cartridge case neck from extractor.</li> <li>4) wipe and lubricate cartridge chamber.</li> </ol> <p>If stoppage repeats, send machine gun to workshop.</p>
5	<p><u>Non-extraction of spent cartridge case from cartridge chamber of barrel.</u></p> <p>After firing, cartridge case remains in cartridge chamber. Movable system and bolt support lever move forward, stop, and do not reach forward position since with feed of</p>	<p>Drop off of extractor hook from cartridge case rim as a result of:</p> <ol style="list-style-type: none"> <li>a) fouling of cartridge chamber or cartridge;</li> <li>b) Buildup of dirt and carbon on rim of bolt frame seat;</li> </ol>	<p>Open receiver, unload machine gun, and set safety in "Stop" position.</p> <p>Push remaining cartridge from cartridge chamber with cleaning rod.</p> <p>If stoppage is not eliminated:</p> <ol style="list-style-type: none"> <li>1) clean and lubricate cartridge chamber and cartridges;</li> </ol>

Sequence No.	Description of Stoppage	Cause of Stoppage	Means of Elimination of Stoppage
1	2	3	4
5 contd.	next cartridge into cartridge into cartridge chamber it rests on the unextracted cartridge case.	c) wear, twisting or breakage of extractor hook.	2) clean dirt and carbon off rim of bolt frame seat; 3) replace unserviceable parts-extractor or its spring.
6	<u>Failure to fire</u> Cartridge is fed into cartridge chamber. Movable system is in extreme forward position but firing does not follow.	1. Presence of thickened grease or fouling on the movable system. 2. Weakening or breakage of main return spring. 3. Twisting or breakage of firing pin. 4. Defect in primer or cartridge (dryout of cartridge or deep seating of primer)	Retract movable system and continue firing. In case of repeated stoppage: 1) clean and lubricate moving parts; 2) with malfunction of main return spring, replace it or send machine gun to workshop; 3) with malfunction of firing pin, replace it; 4) inspect cartridges and remove unserviceable ones.
7	<u>Failure of movable parts to reach extreme rear position.</u> Movable parts and bolt support lever in moving backward do not reach extreme rear position	1. Fouling of parts in contact and accumulation of carbon in gas tracts. 2. Insufficiently vigorous recoil of movable system.	Retract the movable system and continue firing. If stoppage repeats, lubricate movable system through opening in receiver housing by raising receiver upward.

Sequence No.	Description of Stoppage	Cause of Stoppage	Means of Elimination of Stoppage
1	2	3	4
7 contd.			<p>If stoppage does not cease in so doing, clean fouling off parts in contact, remove carbon from gas ports of chamber and regulator.</p> <p>If stoppage repeats, set gas regulator on larger gas opening.</p>
8	<p><u>Non-ejection of spent cartridge case.</u></p> <p>With full recoil of movable system, cartridge case does not eject and does not drop through longitudinal opening outside.</p>	<p>Breakage of ejector</p>	<p>Recharge machine gun and continue firing.</p> <p>If stoppage repeats:</p> <ol style="list-style-type: none"> <li>1) replace ejector or bolt as a whole;</li> <li>2) reset regulator on larger opening;</li> <li>3) clean and lubricate machine gun at first opportunity.</li> </ol>

## CHAPTER VII

### INSPECTION AND PREPARATION OF THE MACHINE GUN FOR FIRING

#### GENERAL REGULATIONS

99. Inspection of the machine gun is performed at times established by the Garrison Service Manual.

100. The extent of disassembly and inspection of machine guns is determined by commanders in accordance with the situation.

a) If the machine gun has been normally stored and has not been used since the last cleaning, - inspect it only in assembled form.

b) If the machine gun has been taken on exercises, training without firing, and other instances when it has not undergone severe fouling, and also with repeated cleaning after firing, - disassemble and inspect only fouled parts and mechanisms.

c) Complete inspection is performed:

- in the event of severe fouling of parts and mechanisms after prolonged firing and training;
- in preparation for winter and summer periods and in changing from summer lubricant to winter, and vice versa;
- in the event of prolonged storage;
- before zeroing in.

101. The section commander and the gunner must inspect the machine gun daily.

102. The equipment for the machine gun and the laid out spare parts are checked before inspecting the machine gun.

103. Inspection of the cartridges, cartridge belts, and ammunition boxes is performed simultaneously with the inspection of the machine guns.

104. All defects or damages noted during the inspection of materiel are



eliminated promptly within the unit, replacing the unserviceable parts with serviceable ones (from spare parts).

105. Defects noted during inspections are recorded in the weapon inspection book (or gun book).

#### INSPECTION OF THE MACHINE GUN BY THE GUNNER AND SECTION COMMANDER

106. During the daily inspection of the machine gun, the gunner and the section commander check:

- whether there are rust film, fouling, nicks, deep scratches on the metal parts, and cracks and splitting on the wooden parts;
- whether all parts and mechanisms of the body of the machine gun and mount are correctly assembled (all machine gun part numbers must agree with the number of the receiver housing);
- whether the front and rear sights are serviceable, that the front sight guard does not move from its seat (whether the corresponding graduation of the scale on the guard coincides with the mark on the sight base);
- whether the movable system moves smoothly and whether it jams;
- whether the trigger group and safety mechanism, the traversing, elevating, and fine aiming mechanisms are serviceable;
- whether the shield, muzzle brake, fastening nuts and screws are reliably secured;
- whether there are unserviceable accessories, spare parts and bags for them, cartridge belts, metal ammunition boxes, and covers assigned to the machine gun, and whether they are present.

107. Before going out on an exercise or for firing, the section commander and the gunner are obliged to carefully inspect the machine gun as a whole to make sure of its serviceability and combat readiness.

108. In addition to the daily inspection, the section commander and the gunner inspect the machine gun in disassembled form at time of cleaning and in assembled form upon its conclusion.

109. The accessories for cleaning the machine gun are inspected before cleaning, and the spare parts during cleaning.

110. The gunner is obliged to immediately report each defect appearing during inspection of the machine gun to his section commander, and subsequently, to the platoon commander.

111. Defects in the machine gun which cannot be eliminated with the resources of the unit are eliminated in the ordnance workshop.

#### INSPECTION OF THE MACHINE GUN IN ASSEMBLED FORM

112. Inspection of the machine gun in assembled form is performed in the following sequence.

a) Check the condition of the machine by external inspection, following the regulations in item 106.

b) Inspect front and rear sights. Consider the rear and front sights serviceable when:

- the rear sight base is securely fastened to the receiver housing and there is no play;
- the sight leaf is not bent, turns freely on its pin, has no lateral play, and is reliably held by the spring and follower in the vertical or swung back position assigned to it;
- there are no nicks or burrs on the leaf shanks to hinder free motion of the elevating slide; the elevating slide does not have excessive side play; under pressure on the clamp, the elevating slide moves freely along the sight leaf, and when released, remains securely in the position assigned to it;
- the motion screw with knob smoothly shifts the elevating sight along the sight leaf; there are no nicks or fouling on the open backsight;
- the front sight has not been hit, is not bent, and is held securely in the recess of the guard; the screw nut is tightened and secure;
- the front sight guard is firmly seated in the grooves of the front sight base and there is no play; the sight reference notch of the front sight guard coincides with the corresponding mark on the base of the front sight.

c) Check the barrel. The barrel is considered to be serviceable when:

- the muzzle brake is turned as far as it will go and is firmly held on the barrel, there is no fouling, and it does not have deep nicks;
- the front sight base with the front sight and guard is firmly held on the barrel and has no play;
- the gas chamber with regulator and tapered support are firmly held on the barrel by the pin;
- there are no indentations and twisting of metal on the ribbed surface and in the shaped groove for the lug of the piston guide tube.

d) Check the connection of the barrel with the receiver housing. Consider it serviceable when:

- the barrel, connected with the receiver housing and secured by the wedge, has no longitudinal play and rotation;
- the barrel wedge nut is screwed on and tightened as far as it will go;
- the back stop of the piston guide tube is firmly engaged with the barrel.

e) Check correctness of assembly and connection of the back plate of the machine gun and trigger housing with the receiver housing. The connection of the back plate with the receiver housing is considered correct when:

- the back plate is firmly seated in the grooves of the receiver housing and has no longitudinal and lateral play; the back-plate pin set in the cross opening of the receiver housing is firmly kept from dropping out by its spring part;

- the tube of the buffer spring is turned as far as it will go and has no play;

--- the trigger housing is correctly screwed into the longitudinal grooves of the receiver housing and there is no play and longitudinal shifting in the grooves;

- the hinge lugs of the trigger housing reliably hold the body of the machine gun on the mount with the screw tightened;

- the safety stop shifts freely from the "Fire" position to the "Stop" position and back, and is reliably held in the position assigned to it.

f) Check the action of the movable system, trigger, and safety mechanisms.

1. Withdraw the movable system with its charging handle as far as it will go. The operation of the movable system is considered correct when:

- its recoil proceeds smoothly, without jumps and jamming, with marked resistance of the main return spring;
- the bolt support with the bolt moves smoothly and freely in the grooves of the receiver housing;
- when the piston guide tube is disengaged from the barrel, the bolt support with the bolt moves in the grooves of the receiver housing smoothly and without jamming;
- when the lugs of the piston guide tube are engaged with the barrel, the bolt support recoils with force but without jamming and jumps to the extreme rear position;
- with the movement of the movable system forward, the sear is pressed in the sear notch of the bolt support and reliably holds the bolt support in this position;
- when the trigger lever is squeezed, the lower part of the lever is fed
- when the trigger lever is squeezed with the safety stop in the "Stop" position, the bolt support, set by the sear notch on the sear, does not move forward,

## 2. Let the movable system go forward.

Operation of the movable system is considered correct when:

- when the trigger lever is squeezed with the safety stop in the "Fire" position, the bolt support moves forward forcefully, without jumps and jamming under the action of the main return spring;
- the piston enters the regulator with the front end, freely, without sticking;
- there is a gap between the barrel pin and the front face of the bolt, between the bolt feed rib and the extractor; with the bolt sent into the forward position, the size of the gaps is not less than 0.1 mm;
- the bore rests firmly against the bolt, i.e., the recoil lugs will cover charge No.2 (a force of 11-28 kg), and will not cover No.9 (a force of up to
- after stopping squeezing the trigger lever, it returns to the forward position.

g) Check the reliability of fastening of the receiver, the correctness of its assembly, and failure-proof operation. The fastening and assembly of the receiver is considered correct and its operation failure-proof when:

- the receiver sear reliably holds the receiver in the closed position;
- with disconnection of the sear, the receiver is freely lifted up on its axis, and in the swung back position is held by the retainer;
- the lever is held in the forward position by the catch;
- there is a gap between the receiver housing and the lever of not less than 0.1 mm;
- during recoil of the bolt support, the lower pawls jump over the next cartridge fed by the upper pawls into the receiver opening;
- with forward movement of the bolt support, the upper pawls jump over the next cartridge;
- there is no sticking of the bolt as a result of friction against the base of the receiver and the tooth of the cartridge depressor.

h) Check the connection of the machine gun body with the mount. It is considered correct when:

- the receiver housing trunnions have gone into the trunnion seats of the mount, are firmly pressed by the removable trunnion caps and secured by bolts;
- the connecting bolt of the rear fastening is screwed in as far as it will go and keeps the body of the machine gun from rocking on the mount;
- the body of the machine gun, connected with the mount and secured by clamps, has no lateral, vertical, or longitudinal play.

i) Check the condition and operation of the traversing mechanism. The traversing mechanism is considered serviceable when:

- with the traversing clamp lever unfastened, smooth turning of the machine gun body left and right is provided;
- with the traversing clamp lever fastened, the swivel is held in any position assigned to it;
- the coupling bolt of the traversing clamp screws in and unscrews freely and without hindrance, and its lever is not bent.

j) Check the condition and operation of the rough and fine elevating mechanisms (the tipping parts). The elevating mechanisms are considered correct when:

- with the unfastening of the rough elevating clamp lever, the tipping part of the mount together with the body of the machine gun is freely moved up and down;

- with the rough elevating clamp lever secured, the tipping part with the body of the machine gun is held in any position assigned to it;

- with the unfastening of the fine elevating clamp lever and rotation of the knob, the body of the machine gun is raised and lowered smoothly, without pulling, and with it secured it is held in any position assigned to it.

k) Check the serviceability and operation of the charging handle. The charging handle is considered serviceable when:

- with the handle drawn forcefully toward you, the movable system is with drawn into the extreme rear position;

- with the handle sent forward, it moves freely, without sticking, and stops at the previous place.

l) Check the serviceability of the wheels of the mount. The wheels are considered serviceable when:

- there is no loose shaking in the connections of the wooden parts with the hubs;

- the wheels turn freely on their axles;

- the screws are tightened down with nuts and secured with cotter pins;

- there are no breaks and cracks in the metal and wooden parts;

- the carriage of the mount with the wheels is freely separated from the mount and connects to the base of the mount.

m) Check the shield fastening. It is considered serviceable when:

- with the levers of the shield fasteners lowered, the shield will not pull out of the grooves of the mount swivel;

- the shield does not rock on the mount.

n) Check the serviceability of the buffer bracket and nut. They are considered serviceable when:

- the bracket, the bracket lugs, and its catch for fastening the ammunition box have no dents and cracks;

- the buffer nut is correctly screwed on and fastened with a cotter pin.

o) Check the serviceability of the back leg lock, the front leg clamps, and the arm rests. They are considered serviceable when:

- with the moving of the back leg lock lever downward, the leg is freed from the clamp, and when the lever is moved upward, the leg is secured;

- with the raising of the handle of the front leg clamp upward, the legs



are released to extend them to the sides (when setting the mount for firing on aerial targets); with the lowering of the handle of the front leg clamp, the legs are reliably secured, whereby they are prevented from spreading to the sides (during firing on ground targets);

- the arm rests in the closed position are held firmly by the fastener, and in the extended position by the hinge;

- the coupling bolt of the base of the arm rests reliably holds the base of the arm rests when they are set height-wise and lengthwise.

#### INSPECTION OF THE MACHINE GUN IN DISASSEMBLED FORM

113. When inspecting the machine gun in disassembled form, pay special attention to the corresponding numbers. If parts are observed with other numbers, the machine gun is considered to be unserviceable.

After careful inspection and checking the machine gun by firing, record the numbers of the parts in the gun book.

114. In the disassembled state of the machine gun, inspect each separate part and mechanism of it in the following sequence.

a) Perform inspection of the barrel. The barrel is considered serviceable when:

- the muzzle brake screws on freely as far as it will go;
- with the wedge removed, the barrel freely comes out of the channel of the receiver housing;
- the barrel is inserted in the channel of the receiver housing freely and easily;
- the barrel wedge and washers freely enter the opening, and with the nut screwed on, hold the barrel from longitudinal rocking and turning;
- the channels for the passage of powder gases in the barrel, in the chamber and regulator of the gas chamber are not beaten in and are not fouled;
- the regulator is firmly fastened in the gas chamber by the nut and pin; the channels of the front and rear lugs of the gas chamber do not have dents and cracks;
- the shaped groove for the lower lug of the piston guide tube does not have nicks and cracks.

When inspecting the front sight, the front sight base, and the guard, follow the instructions in item 112.

When inspecting the barrel internally, pay attention to the condition of its rifled part and its cartridge chamber.

The following are considered to be defects in the rifled part of the bore and the cartridge chamber:

- rust, which is observable in the form of a dark film; rust which is not noted by the eye can be observed by wiping the bore with a clean wiping rag, on which, if rust is present, brown spots will remain;

**Note.** A dull surface of the bore, if no traces remain on the wiping rag when wiped, is not a defect.

- honeycombs - the primary damage to the bore, observable in the form of separate spots or fine specklings located in separate places or all over the barrel;

- rust traces in the form of dark fine pits which remain after removal of rust;

- rust spots - significant pits in the metal;

- copper fouling, appearing when firing bullets coated with tombac and observable in the form of a light copper film on the walls of the bore;

- scratches in the form of little lines, sometimes with marked lifting of the metal along the edges;

- nicks on the muzzle and breech faces;

- rounding of the rifling lands, especially noticeable on the left (driving) side of the land;

- bulge, observable in the form of a dark cross ring, solid or broken.

Inspection of the barrel must be made visually. The barrel is wiped dry before inspection.

For inspection, place the barrel on a support at eye level, and rotate it so that the bore is illuminated now brightly, and now with weak light along the entire length.

When inspecting the middle part of the bore bring the eye close to the edge of the barrel, and when inspecting the closest part, remove the eye from the edge.

Send the barrel to the repair unit:

- if the barrel will not ensure normal action;
- in the event of bulging of the bore;
- when nicks are observed in the cartridge chamber which prevent free entry of the cartridges and extraction of the cartridge cases, and also deep traces of rust;
- in the event of a worn condition of the threading for connection with the muzzle brake.

b) Inspect the receiver housing. The receiver housing is considered serviceable when:

- there are no nicks, twisting, fouling, cracks, and other mechanical damages to reduce the strength and to prevent the connection of parts and mechanisms during assembling, and also disrupting correct movement of the movable system during firing, in particular, on the interior surfaces of the receiver housing, especially in the longitudinal grooves for the bolt in the bolt support, in the sloped openings under the recoil lugs, in the channel and the longitudinal groove for passage of the barrel stop lug, in the cross opening for the barrel wedge, in the openings for the back-plate pin, in the vertical grooves for connection of the back plate, and in the longitudinal grooves for the trigger housing lugs;

- there are no nicks, twisting, fouling, cracks, and other mechanical damages on the external surfaces of the receiver housing, especially in the grooves for mounting the antiaircraft sight, in the recess for holding the receiver, in the holes for connecting the receiver, on the trunnions for securing to the tripod mount or other mount, in the opening under the base of the receiver, and on the guide pin;

- the trunnions freely enter the recess on the tripod mount or other mount and are firmly secured by the caps;

- there are no hammer marks and broken threading on the barrel wedge and its nut;

- the pin of the back plate is not bent, and its slotted part springs when set in the cross opening.

c) Inspect the rear sight. The rear sight is considered serviceable when:

- the sight base is firmly fastened to the receiver housing and its lugs are not fouled and are not broken;

- the sight leaf, sight leaf spring, follower, motion screw with knob do not have cracks and breaks, are not bent, and operate correctly;
- the motion screw works correctly, the catch reliably holds the elevator slide in the assigned position;
- the sight leaf is reliably held in the raised or folded down position and has no play;
- in the opening for the tooth of the catch of the receiver base there are no nicks and twisting of metal;
- the eye of the leaf, its heel, and limiting lug are not twisted and not broken.

d) Inspect the bolt and its parts. The bolt is considered serviceable when:

- there are no cracks, crumbling, and dents on the frame of the bolt, especially in the openings for the recoil lugs and cut-outs for the thickened part of the striker;
- the collar of the seat of the bolt frame is not broken and not crumbling;
- there are no cracks around the opening for the exit of the firing pin and no significant erosion of the metal;
- the extractor with spring and pin, the ejector, the recoil lugs, striker and firing pin are not crumbling, and do not have nicks and burrs, move freely in their openings, and the extractor spring does not have a sag or a break;
- when the bolt with striker is pressed against the post of the bolt support, the firing pin's exit varies within limits of 1.4 - 1.6 mm;
- the bolt arm has no burrs, cracks, crumbling of metal, and is reliably connected with the bolt support;
- the cylindrical channels inside the frame of the bolt have no burrs, scratches, and fouling to prevent free movement of the firing pin and striker;
- the shoulders of the striker at the back bridge do not have much sag; the striker is firmly held by its lateral slots in the cut-out of the bolt support post;
- the rib, the front edge of which is the feeder, does not have dents and crumbling of metal, and its inclined channel is not fouled.

e) Inspect the bolt support and its parts. The bolt support is considered serviceable when:

- there are no burrs, nicks, and cracks on the ribs of the support at the location of the shaped opening under the bolt lug and recoil lugs;
- the support handle and bushing are firmly fastened and have no play; there is no rough crumbling of metal on the working edge of the bushing;
- the bolt support is firmly connected with the coupling, and the coupling with the piston, the threading on the piston and coupling are serviceable;
- the rod and gas piston are not bent, have no crushing, nicks, and cracks, and the piston is not battered;
- there are no nicks, cracks, and crumbling of metal on the guide lugs and in the longitudinal opening for ejection of the cartridge cases;
- the main return spring is intact, and there are no cracks, burrs, and fouling;
- the piston guide tube is not bent and there is no crushing, it has no nicks and cracks, especially at the back stop (in the place where it is welded onto the tube).

f) Inspect the trigger housing, the trigger and safety mechanisms. The trigger housing and safety mechanism are considered serviceable when:

- there are no nicks, burrs, cracks, and crushing on the ribs of the grooves, on the edges and lugs of the trigger housing;
- the sear, sear spring, sear lever and its pin have no burrs and dents; there is no rough crumbling or raising of metal on the working edge of the sear;
- the sear returns forcefully to the initial position under the action of the spring;
- the recesses to accommodate the sear with spring, the safety stop with spring, and sear lever are not battered and not fouled;
- the safety, safety stop, and its spring have no dents and cracks;
- the safety moves freely from the "Fire" position to the "Stop" position and back, and is held reliably in both positions by the safety stop;
- there are no cracks, nicks, and crushing in the opening for mounting on the tripod mount or other mount.

g) Inspect the back plate and its parts. The back plate is considered serviceable when:

- there are no nicks, burrs, crushing, and cracks on the ribs of the grooves and lugs of the back plate;

- there are no nicks, raising of metal, and cracks in the smooth opening to accomodate the buffer and in the threaded opening for screwing in the buffer tube;

- there are no dents, burrs, and fouling in the recess for the head of the striker;

- the bolt support buffer is not bent and its front surface has no nicks and crumbling of metal, the buffer spring is not broken, and has no cracks and fouling;

- the buffer tube is turned down as far as it will go and its pin is reliably seated;

- there are no cracks or defects where the trigger lever is welded to the trigger hooks;

- there are no cracks, nicks, and crushing in the opening for connecting the trigger lever;

- there are no chips and cracks on the back-plate handles.

h) Inspect the receiver and its parts. The receiver is considered service when:

- there are no nicks, bowing, and cracks on the lugs and ribs of the receiver grooves, the base of the receiver and the cover, and on the rest of the parts;

- the cartridge depressor, the link lifter, and the bed of the receiver have no play and no dents;

- the lever locking device, the lower and upper pawls return forcefully to the initial position under the action of their springs;

- the bed is held firmly in the feed block cover;

- the slide lever is reliably connected with the feed block cover; the lever turns freely on its pin under the action of the bolt support lever;

- the cartridge passes freely under the link lifter; the slide with lever and upper pawls freely move in the grooves of the bed;

- the feed block cover catch under pressure does not spring it and there is not much play;

- the pin with the nut and the hinge lug of the receiver are not bowed and do not have much lateral play.



115. Check the serviceability of the belt. The belt is considered serviceable when:

- the belt links are firmly connected to each other by the hinges, are not torn apart and not spread, and do not have crushing and cracks;
- the spring horns and link stops of the belt hold the cartridges in the correct position and prevent them from dropping out.

116. Check the serviceability of the ammunition box. The ammunition box is considered serviceable when:

- the large fold-back cover and its catch open and close freely;
- the handle of the large cover is not torn off and is firmly secured;
- the spring tongue attached to the inner side of the large cover is not bent, and springs;
- the flap (small cover) swings back outside freely, rests on the mount, and, when taken from the mount, folds inside the box (over the inclosed belt);
- the hooks have no dents and breaks, and are firmly attached to the box and hold it reliably on the mount bracket.

117. Inspect the live cartridges. Live cartridges are considered serviceable when:

- there are no cracks, scratches, and crushing on the cartridge cases to hinder the free entry of the cartridge into the cartridge chamber;
- the bullet is held firmly in the casing, without free play and longitudinal motion;
- the primer is serviceable, there are no misfires, the cartridges are sorted out;
- there is no verdigris and rust on the primers and casings.

118. Inspect the accessories:

a) The oil cans for lubricant are considered serviceable when:

- there are no crushes and splits on them;
- the washer is placed between the neck of the oil can and the cover;
- the cover (a screw-on stopper) does not let the lubricant out.

b) The jointed cleaning rod is considered serviceable when:

- the sections screw into one another freely, and, when screwed in as far as they will go, have no play;

- sharp angles on the ends of the sections are blunted;

- the sections of the cleaning rod are not bent, and do not have burrs and dents;

- the first section of the cleaning rod is firmly secured in the handle, but has free rotation; the second and third section (on the threaded part) do not have dents, and freely screw into the handle of the cleaning rod and unscrew from it;

- the ribs of the slots for the cleaning tow are blunted and have no cracks;

- the tip of the cleaning rod is not bent and firmly holds the sections from lateral play (with a turned position in the handle of the cleaning rod).

c) The bent rod and brush are considered serviceable when:

- the bent rod is not bent out of shape;

- the brush is not bent and not worn bare;

d) The wrench for the gas chamber and barrel wedge is considered serviceable when:

- the wrench has no cracks, dents, and metal wear;

- the cut-outs for the nuts of the regulator, bolt support buffer, barrel wedge, and receiver pin are not worn down, and have no crumbling and dents.

e) The wrench-screwdriver is considered serviceable when:

- the wrench-screwdriver does not have cracks, dents, crumbling, and metal wear;

- the recess for the front sight nut and the front sight base bolt, the cut-out for the rod of the gas piston, and the nut of the bolt support lever pin are not worn down and not crumbling;

- the tip of the wrench-screwdriver is not bent, not battered, and not crumbling and blunted in correspondence with the width of the screw slots.

f) The extractor is considered serviceable when:

- the head does not have dents and burrs, is held firmly in its place, and freely goes into the seat of the bolt frame;

- the spring rod freely slides along the inner rod;

- the ends of the spring and inner rods are not bent and not crumbled.

g) The punches are considered serviceable when the ends are not bent and not broken.

h) The cleaners of the regulator (large and small) of the gas chamber and their twists are considered serviceable when:

- there are no cracks, deep dents and crumbling on the teeth of the mills;
- the cleaners are not bent, and do not have dents and crumbling which prevent free entry into the openings for the passage of gases;
- the twists of the cleaners are not bent, and do not have dents, cratches, and thickening on the ends.

i) The nut wrench for the mount is considered serviceable when:

- the wrench does not have cracks, dents, crumbling and wear of metal;
- the openings and cut-outs for the respective nuts and screws are not worn down and do not have crumbling and cracks.

j) The hammers (machinist and wooden) are considered serviceable when:

- the hammer is firmly seated on the handle;
- there are no cracks, chips, and dents on the hammer and handle.

k) The small spare parts are considered to be in order when they are thoroughly cleaned, lubricated, and wrapped in oiled paper.

l) The bag for accessories and spare parts is considered serviceable when:

- the fabric of the bag and the shoulder strap are not torn;
- the pockets for holding the accessories and spare parts are not clogged, are not torn, and button reliably.

119. The canvas covers are considered serviceable when:

- the covers for the body of the machine gun, spare barrel, and tipping part of the mount swivel are not torn, and their interior parts are not contaminated;
- the covers are thoroughly dry and button reliably.

#### PREPARING THE MACHINE GUN FOR FIRING

120. Preparation of the machine for firing, as a rule, is performed at the time of cleaning and lubricating.

In order to prepare the machine gun for firing, it is necessary to:

- disassemble the machine gun;
- inspect the machine gun in disassembled form, as outlined in items 113,

114;

- assemble the machine gun;
- inspect the machine gun in assembled form as outlined in item 112;
- inspect the belts and ammunition boxes as outlined in items 115, 116;
- load the belts.

121. Before loading the belts, inspect the cartridges and remove the unserviceable ones. Do not load the belts with unserviceable cartridges (those with cracks and dents on the cases, with deeply set and verdigris covered primers, weakly crimped, loose bullets, and with verdigris on the surface of the case and crumbling).

After loading the belt with cartridges and checking the correctness of their position in the belt, put it in the box, for which:

- swing back the large cover of the box to the left;
- place the loaded belt in the box "accordion style" (in equal rows, bullets to the front);
- close the large cover of the box on the latch.

122. Lightly lubricate the moving parts with No.21 oil when preparing the machine gun for firing under winter conditions.

## CHAPTER VIII

### TEST AIMING AND ZEROING IN OF MACHINE GUNS

#### GENERAL REGULATIONS

123. All machine guns in the hands of units must be zeroed in.

Test aiming is performed:

- when the machine guns arrive as armament of the unit;
- after replacement of parts and repair of the machine which could have an effect on its aim;
- when abnormal deflection of bullets is observed during firing.

In a combat situation, each commander is obliged to use all possibilities for checking the aim of the machine guns in his unit.

124. Test aiming of the machine guns is performed by the platoon commander and the company commander. Senior chiefs to the commander of the unit are exclusively obliged to watch over strict observance of the rules for testing.

125. Fire for test aiming of machine guns is performed by test firers placed at the disposal of the commander from among the best gunners.

126. Before test aiming of a machine gun, it is carefully inspected and noted defects are eliminated.

The armorer or master gunsmith with a selection of spare parts and necessary tools must be present at the test aiming.

127. Test aiming is performed in the presence of the machine gunners for whom the machine gun is secured, and their section commander.

128. Test aiming is performed under favorable conditions of weather and lighting, in an indoor range or on a sector of the firing range protected from the wind.

129. The machine gun is set for test aiming on a level area of as firm as possible turf ground ensuring stability of the machine gun during firing and excluding the possibility of its settling.

The machine gun is set up without side tilt (checked by the eye). In order to eliminate minor tilting the ground is slightly cleared under the higher-standing wheel or the gun is shifted to another place. It is not allowed to spread dirt under the lower-standing wheel.

During firing, the base of the mount is set approximately in the horizontal position. It is forbidden to dig ground out from under the wheels and legs of the mount for correct setting of the base.

The spade of the mount must be sunk in the ground far enough so that the right and left lags of the mount are resting equally on the ground.

If necessary, test aiming is conducted with loose, soft, or very hard soil (sand, stony or frozen ground) and a layer of felt is placed under the wheels and spade.

#### TEST AIMING OF MACHINES GUNS WITH ORIGINAL BARREL

130. Test aiming is performed by firing at 100 m with sight 3 setting (for model 1938 machine guns manufactured prior to 1942 - with sight 3, back sight 0). Fire is conducted with cartridges with B-32 bullets from the same plant and from the same lot.

131. The target used for firing is a white square (Fig.65), 30x30 cm size, with black and control disks 20 cm each in diameter. For rapid determination of deflection, the square is divided into small squares 1x1 cm in dimension. The distance from the lower edge of the black disk to the center of the control disk equals 9 cm.

The center of the lower edge of the black disk serves as the precise aiming point. The aiming point is set approximately at the height of the body of the machine gun.

132. For purposes of establishing accuracy of aim and position of center point of hit, the gunner fires a set of 8 single rounds with careful and uniform



aiming under the center of the lower edge of the black disc with a correction of aiming before each round.

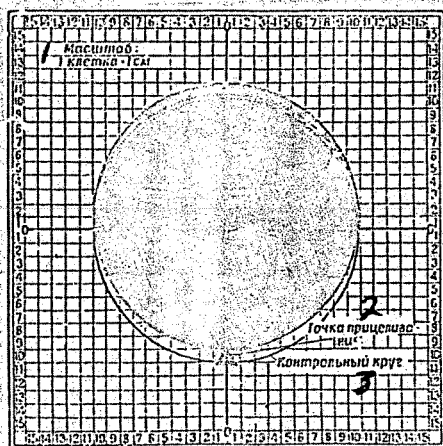


Fig. 65. Target for test aiming of machine gun

Key: (1) Scale: 1 square = 1 cm;  
(2) Aiming point; (3) Control disk

133. Upon conclusion of firing, the target is inspected and from the location of the bullet holes the accuracy of aim of the machine gun and the position of the center of point of hit are determined.

a) The machine gun is considered to be zeroed in if no less than 6 bullet holes fit in the control disk.

b) In case of necessity, the front sight guard is moved left or right of its center position by no more than 3-4 mm in each direction. After each tightening or unscrewing of the front sight, the front sight nut is tightened.

c) If fewer than 6 bullet holes are in the control disk, the machine

gun is inspected and its mounting checked, after which, firing is repeated.

In the event of a repeated unfavorable result of firing, the machine gun is sent to the ordnance workshop for precise revelation and elimination of the causes of shot dispersion. The firing range card with note of hits obtained is sent along with the machine gun (first and repeated firings).

d) When the machine gun has been zeroed in, the position of the front sight guard is recalled according to the graduation marks on the back post of the base of the sight.

e) The result of the aiming of the machine gun is recorded in the gun book.

f) When zeroing in of the machine has been completed, <sup>Do</sup> it is not allowed to unscrew or screw in the front sight.

## CHECKING AIM OF SPARE BARRELS AND MARKING THEM

134. Checking the aiming of spare barrels is performed according to the rules set forth in items 130-133.

Note. Since 1952 machine guns have not been made up with spare barrels.

135. Barrels are marked at the plant: the original - with the number of the machine gun and a figure, for example, No.446 -1; the spare - with the number of the machine gun and the serial number of the barrel, for example, No. 446- 2.

## DEFECTS OF A MACHINE GUN DISRUPTING ITS ZEROING IN

136. Characteristic defects which disrupt zeroing in of the machine gun.

a) Abnormal deflection of bullets during firing. in respect to elevation or lateral direction is due to the following causes:

- striking the front sight or a bend in its tip - the bullets are deflected in the direction opposite to the shift in the tip of the sight;
- a bend or warping of the rear sight leaf - the bullets are deflected to the right and downward if the sight leaf is bent to the right; to the left and downward if the leaf is bent to the left;
- there are nicks on the barrel face - the bullets are deflected in the direction opposite the nick;
- in the model 1938 machine manufactured prior to 1942 the motion screw is bent up or down - the bullets are deflected in the direction of the bend.

b) Abnormal dispersion of bullets during firing occurs for the following reasons:

- tearing of the bore, especially in the muzzle part;
- wearing down or rounding of the lands of the rifling;
- presence of rust, scratches, and dents in the bore, especially in the muzzle part;
- overheating of the barrel during firing;
- shaking of the mount, wheels, and connections of the mount with the body of the machine gun.

In addition, loose soil ( sand, snow), digging in of the wheels into the ground, incorrect stopping of the spade in the ground, and sharp pressure on the handles of the back plate (from below upward and from above downward) have an effect on bullet dispersion during firing.

c) Abnormal deflection of the bullets in regard to elevation or lateral direction has the following causes:

- the machine gun has tipped to the left(to the right) - the bullets are deflected to the left (to the right) and downward;
- the base of the mount is not set horizontal; if, during traversing fire, the base is set with a backward tilt, there will be short rounds on the flanks of the target, and if the base is set with a forward tilt, there will be rounds beyond the target;
- settling of a leg of the mount - the bullets are deflected upward;
- settling of the wheels - the bullets are deflected downward.

## CHAPTER IX

### STRUCTURAL FEATURES OF THE MODEL 1938 DShK SYSTEM MACHINE GUN AND THEIR HANDLING

#### CONSTRUCTION AND PURPOSE OF PARTS AND MECHANISMS OF THE MACHINE GUN

137. The model 1938 machine gun differs from the 1938/46 model mainly in the following:

- a) The barrel has a threaded connection with the receiver housing. The barrel latch is a bolt, the middle part of which is tapered.
- b) A roller-type counterrecoil is located in the front part of the bolt support. The counterrecoil, together with a fiber ring, is placed on the rod to prevent recoil of the bolt support at the moment of firing.
- c) The bolt frame and recoil lugs, the extractor and the ejector, have certain design features.
- d) There is a bolt buffer (in the back plate).
- e) The receiver is of the drum type.
- f) The collar of the rear sight of machine guns manufactured prior to 1942 has a movable backsight, which is moved by motion screw of the backsight.
- g) Mounts manufactured prior to 1940 have:
  - a limiter of horizontal dispersion with the clamp lever;
  - the sight ring and fine elevating mechanism have a somewhat different design;
  - on the middle part of the rear leg - the fastener for the front legs, and on the back part - the clamp for the front legs;
  - a somewhat different design of the arm rest;
  - a bracket for an optical sight.
- h) The shield has an opening for the machine gunner for the optical sight, covered by a flap.

DESCRIPTION OF PARTS OF THE MODEL 1938 MACHINE GUN  
WHICH DIFFER FROM PARTS OF THE MODEL 1938/46  
MACHINE GUN

BARREL

138. The barrel (Fig.66) has a band thread for connection with the receiver housing and a cross semicircular groove for passage of the barrel lock.



Fig. 66. Barrel:  
1- band thread

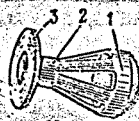


Fig.67. Muzzle brake:  
1- cap; 2- tube; 3- disk

139. The muzzle brake (Fig.67) consists of the brake cap, tube, and brake disk.

REGULATOR

140. The gas regulator has three through openings in the shank with diameter of 3,4, and 5 mm. The figures 3, 4, and 5 are inscribed on the edges of the cylindrical part of the regulator to correspond to the openings.

BARREL LOCK

141. The barrel lock (Fig.68) serves as the final fastening of the barrel to the receiver housing.



Fig. 68. Barrel lock:  
1- head; 2- middle tapered part;  
3- cylindrical threaded shank

It has a hexagonal head, a middle tapered part for connection with the barrel, and a cylindrical threaded shank for screwing into the left wall of the receiver housing.

## RECEIVER HOUSING

142. The receiver housing has a channel in front with threading for screwing in the barrel, a cross opening for the barrel lock, and a recoil block

## BOLT SUPPORT

143. The bolt support (Fig.69) has a screwed on recess with threading for connecting with the gas piston rod, and opening for the pin of the rod, a cross vertical opening for the recoil stop mechanism of the bolt support, and an opening for the recoil stop pin.

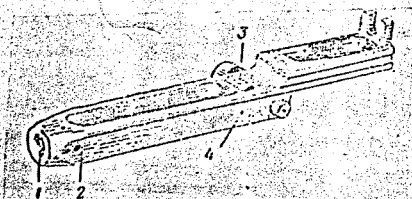


Fig. 69. Bolt support:

- 1- screw-on recess with threading for connecting with rod;
- 2- opening for rod pin; 3- recoil stop mechanism;
- 4- opening for recoil pin

## BOLT SUPPORT RECOIL STOP

144. The bolt support recoil stop serves to eliminate recoil of the bolt support after it hits the bolt in reaching the extreme forward position.

The stop consists of a recoil stop base, a recoil stop roller, roller plunger, two roller plunger springs, and the recoil stop pin.

## BOLT

145. The bolt (Fig.70) has an extractor of different design and a spring



extractor, an ejector with rod and spring, firing pin and firing pin spring, striker, recoil lugs, and bolt frame.

The bolt frame (Fig.71) has:

- two longitudinal channels within: the upper (slanted) for accommodation of the ejector, the ejector rod, and its spring; the lower (axial) for accommodation of the striker, firing pin, and firing pin spring.
- a longitudinal groove below for mounting the extractor with plate spring in it.

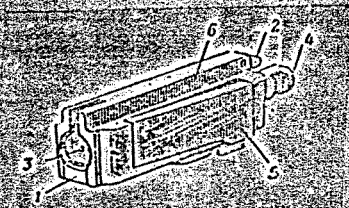


Fig. 70. Bolt:

1- extractor; 2- ejector; 3- firing pin;  
4- striker; 5- recoil lugs; 6- frame

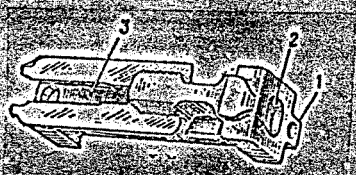


Fig. 71. Bolt frame:

1- channel for ejector with spring; 2- channel for striker;  
3- longitudinal groove for extractor with spring

The extractor with spring (Fig.72) has an extractor tooth for seizing the cartridge rim, a lug for keeping the extractor from longitudinal movement along the frame, and a shoulder for the stop of the extractor plate spring.

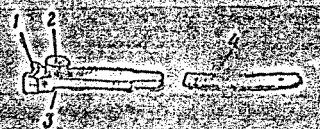


Fig.72. Extractor with spring:

1- extractor tooth; 2- lug; 3- shoulder  
for spring stop; 4- extractor spring

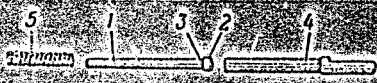


Fig. 73. Ejector:

1- front end of ejector; 2- head;  
3- collar; 4- rod; 5- ejector  
spring; 6- pin

The ejector with spring and pin (Fig. 73) has a head, a collar for the ejector spring stop to hold it in the extreme rear position, and a rod which serves to transmit the shock from the bolt buffer to the ejector; it has an opening for the pin which limits movement of the ejector rod in the bolt frame channel.

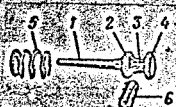


Fig. 74. Firing pin with spring and pin:

1- tapered part; 2- center guide rim; 3- circular neck; 4- rear guide rim; 5- spring; 6- pin

#### BACK PLATE

146. The back plate (Fig. 75) consists of the base of the back plate with two yokes and two grips. The bolt support buffer, bolt buffer with springs and the trigger lever are mounted on the back plate.

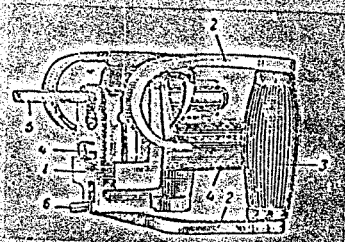


Fig. 75. Back plate:

1- frame; 2- yokes; 3- grip; 4- bolt support buffer; 5- bolt buffer; 6- trigger lever

#### RECEIVER IV

147. The receiver (Fig. 76) consists of the receiver base, the drum of the receiver with pin and ratchet, the catch of the receiver base, the drum catch of the receiver, the receiver cover, receiver cover catch, and the lever-feed.

a) The receiver base (Fig. 77) has:

- in the front part, an opening for the drum pin; two holes for the hinged connection with the receiver housing by means of the pin of the receiver cover; nuts, and a pin; an opening for the passage of the receiver stop lug when it is

swung upward; a channel for guiding the cartridge into the cartridge chamber; two longitudinal grooves for the passage of the bolt feed rib;

- in the middle part, a longitudinal opening for passage of the cartridge; the cartridge spring stop and locking device to eliminate misalignment and for centering the cartridge; cartridge cutout to withdraw the cartridge from the belt when the drum of the receiver turns; a spring hold of the feed-lever is fastened to the cartridge cutout and hinge connected with the cutout by means of the belt stop pin;

- in the back part, a cross opening for the pin of the feed-lever; a screw type recess with left threading for the drum pin; a recess for the catch of the receiver base and a spring catch; an opening for the pin connecting the catch of the drum with the receiver base; an opening for the feed-lever screw; an opening for the catch of the receiver cover and a cross groove for the catch of the cover.

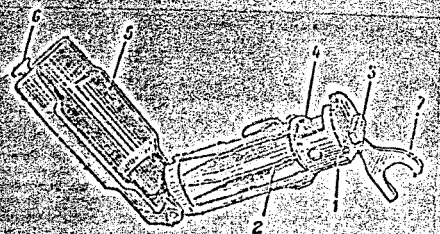


Fig. 76. Receiver:

- 1- receiver base; 2- receiver drum;
- 3- receiver base catch; 4- drum catch;
- 5- receiver cover; 6- cover catch;
- 7- feed-lever

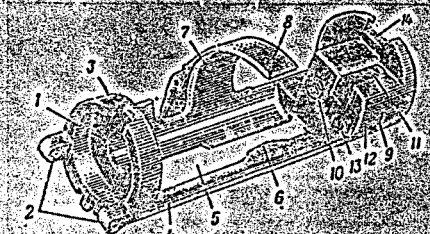


Fig. 77. Receiver base:

- 1- opening for drum pin; 2-holes;
- 3- opening for receiver stop;
- 4- channel; 5- receiver opening;
- 6- locking device; 7- cartridge cutout;
- 8- belt support; 9- opening for feed-lever pin;
- 10- screw recess for drum pin; 11- recess for catch;
- 12- opening for pin; 13- opening for feed-lever pin;
- 14- opening for receiver cover catch



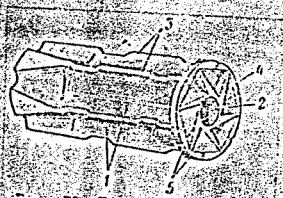


Fig. 78. Receiver drum:

- 1- longitudinal recess; 2- channel for drum pin; 3- drum ribs; 4- ratchet; 5- ratchet recesses

b) The receiver drum (Fig. 78) serves to feed the cartridges in the receiver opening. It has six longitudinal recesses to accommodate the cartridges, a longitudinal channel for passage of the drum pin and lugs for engaging the ratchet.

The receiver drum turns on a pin fastened in the base of the receiver. The drum pin has a head with a cross groove for the blade of the large screwdriver and a back end

with left threading for screwing into the base of the receiver.

c) The ratchet of the receiver drum serves to turn the receiver drum. It has six ratchet recesses for the tooth of the feed-lever which rotate the drum  $1/6$  of the circumference (the tooth of the drum catch prevents turning in the opposite direction); an opening for passage of the receiver pin; cut-outs for the lugs of the drum ribs.

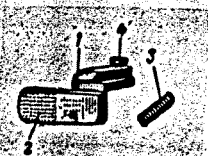


Fig. 79. Receiver base catch:

- 1- tooth; 2- knurling; 3- spring; 4- abutment screw

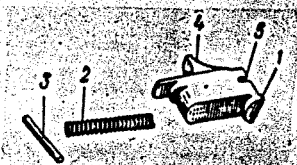


Fig. 80. Receiver drum catch:

- 1- tooth; 2- spring; 3- pin; 4- lug with notch; 5- cross groove

d) Receiver base catch (Fig. 79) serves to hold the receiver in the closed position. It has a tooth, knurling, catch spring, and catch abutment screw. It is necessary to press on the catch in order to raise the base of the receiver.

e) The receiver drum catch (Fig. 80) prevents turning of the drum in the reverse direction at the moment of movement of the movable parts to the forward position when the tooth of the lever comes out of engagement with the ratchet of the drum.

The catch has a lug with a notch for drawing the catch back; in the front part - a cross groove for the catch pin; and a tooth which limits the drum from turning in the reverse direction.

f) The catch spring of the drum holds the catch in the forward position.

g) The catch pin of the drum prevents the catch from dropping out of the recess.

h) The receiver cover (Fig. 81) has a base, hinge lugs, a catch and a pin.

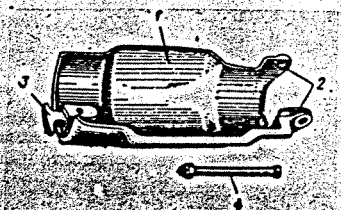


Fig. 81. Receiver cover:

1- base; 2- hinge lugs; 3- catch; 4- pin

when it is swung upward.

1) The receiver cover catch holds the receiver cover in the opened position. It has a tooth, knurling, abutment screw, and a catch spring.

The catch is mounted on its base which is welded to the receiver cover.

The receiver cover pin serves as a hinge connection for the base of the receiver and the cover of the receiver with the receiver housing. The pin has a head, and is fastened by a nut and pin.

The receiver cover is hinge connected with the receiver housing by a pin passing through its hinge lugs, the base of the receiver and the receiver housing. The receiver cover has:

- the catch base on the inner surface in the back part;
- a slanting lug in the front part for grasping the cover of the receiver with the tooth of the stop

#### FEED-LEVER

The feed-lever (Fig. 82) serves for turning the drum of the receiver.

It has:

- a shoulder with fork;
- a cylindrical shoulder-pin;

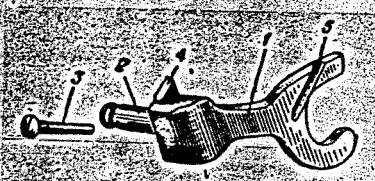


Fig. 82. Feed-lever:

- 1- shoulder with fork; 2- cylindrical shoulder;
- 3- screw; 4- lever tooth;
- 5- groove

- a lug with a recess for tooth of the feed-lever with a opening for the pin;

- a groove on the fork for engagement with the stop of the

feed-lever when the frame approach the forward position;

- a screw connecting the lever with the receiver base.

#### REAR SIGHT

(Manufactured prior to 1942)

148. The rear sight (Fig.83) has a differently designed rear sight leaf with motion screws, a knob, and gears, and also an elevating slide.

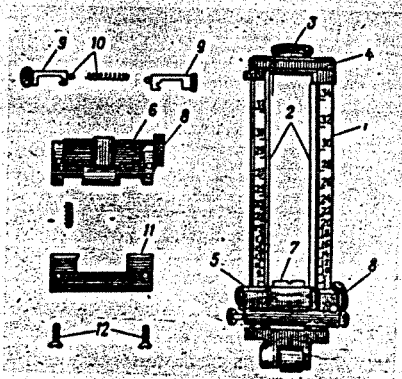


Fig. 83. Rear sight:

- 1- sight leaf; 2- motion screws; 3- knob; 4- gear; 5- elevating slide;
- 6- elevating slide frame; 7- backsight; 8- backsight motion screw; 9- elevating slide catch; 10- plunger with screw- 11- elevating slide plate; 12- plate screw



a) The sight leaf has:

- grooves on the lateral walls for the motion screws;
- a rectangular opening in the upper part for the large gear and two small openings for the ends of the screws;
- motion screws, the lower smooth part of which go into the recess of the sight leaf and the upper smooth end is secured with the small gear with a pin.

Turning of the small gears occurs under the action of turning the knob with the large gear. The knob passes into the opening of the sight leaf and is connected with the large gear by a pin.

b) The elevating slide has a frame, a backsight with motion screw, a knob with pin, elevating slide catch springs, two catches for the elevating slide, a plunger with spring, and an elevating slide plate with two screws.

c) The frame of the elevating slide has:

- a horizontal cylindrical lug for the motion screw with the backsight and knob;
- two lateral vertical lugs to limit lateral movement of the elevating slide of the rear sight on the sight leaf, with openings for the plunger with spring and the plate screws;
- two horizontal lugs in which are mounted the springs with catches.

A scale is inscribed on the rear part of the elevating slide, having on the right and left eight graduations each from zero; the value of a graduation - one graduation of deflection (one mil).

d) The backsight has a threaded opening in the lower part for the motion screw.

e) The motion screw is fitted with a head, on the end of which a knob is placed, secured by a pin.

f) The elevating slide catch spring serves to spread aside the catches. In so doing, the threaded surfaces of the catches engage with the motion screw. A spring is put on the cylindrical ends of the catches.

The two elevating slide catches serve to hold the elevating slide in the position assigned to it on the sight leaf. They have:

- a cut-out in the middle part for the passage of the posts of the sight leaf, and a spiraled surface for connection with the motion screw;
- a button on one end;
- a cylindrical shank on the other end for guiding the spring.

g) The plunger with spring holds the motion spring in the position assigned to it. The plunger with spring is mounted in the recess of the left lateral lug. The end of the plunger goes into one of the grooves on the head of the motion screw and holds the screw from spontaneous turning.

h) The elevating slide plate is fastened to the base of the elevating slide from the back after assembly of all the parts in the elevating slide. The plate is fastened to the base of the elevating slide by two screws which go into the corresponding threaded openings. A cut is made in the upper part of the plate to provide better visibility of the scale which is on the frame of the elevating slide.

#### FEATURES OF MOUNTS MANUFACTURED 1938-1940

##### TRAVERSING LIMITERS AND LIMITERS CLAMP

149. The limiters (left and right; Fig. 84) limit turning of the machine gun in a given sector when firing traversing fire. The limiters consist of split rings with limiting lugs (left and right). The lugs prevent movement of the collar when the clamp is tightened. The limiters are mounted in the annular groove of the base. The left limiter is set in the annular groove between the braking ring and the right limiter. The braking ring is mounted in the annular groove with the limiter clamp prior to placing the limiters in the annular groove

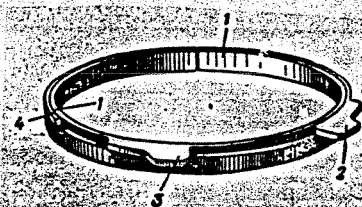
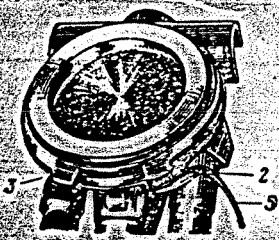


Fig. 84. Limiter

1- split ring; 2- right limiter lug; 3- left limiter lug; 4- braking ring;  
5- limiting clamp with handle

The shank of the clamping wedge is accommodated in the opening of the screw coupling which turns with turning of the handle in a cylindrical lug of the base and releases the clamping wedge. The end of the shank of the clamping wedge is threaded for a nut. The screw coupling presses on the upper surface of the nut (when it is screwed out of the lug) and thus moves the clamping wedge downward. The wedge forces open the braking ring.

#### FINE ELEVATING MECHANISM

150. The fine elevating mechanism (Fig. 85) consists of an outer raising screw, a ring with graduations, and a spring ring, an inner raising screw, elevating nut, raising screw, knob, pin, and an indicator. The head of the inner raising screw is connected with a pin inserted in the bracket of the lower tipping base. When the knob is turned, the nut remains motionless. The head of the inner raising screw, connected with the pin, moves. It moves the bracket of the lower tipping base a little. As a result of this movement, precise vertical aiming of the machine gun is effected.

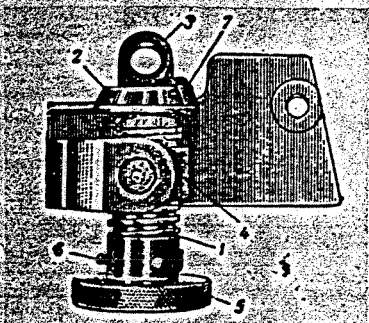


Fig. 85. Fine elevating mechanism:

- 1- outer raising screw; 2- aiming ring;
- 3- head with inner raising screw;
- 4- elevating nut; 5- knob; 6- pin;
- 7- indicator

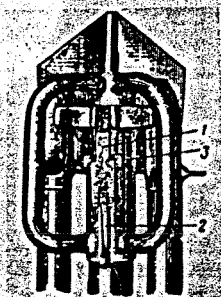


Fig. 86. Front leg lock:

- 1- lock frame; 2- lock lever;
- 3- pin

#### FRONT LEG LOCK

151. The front leg lock (Fig.86) consists of a frame, lever, and a plate. The frame of the lock is hinge connected with the spade of the mount. It has two lateral lugs which press the ends of the front legs against the spade. In order to free the front legs (when shifting to fire against aerial target) the front end of the lock is raised up.

#### BACK LEG OF THE MOUNT

152. The back leg of the mount has a lug for fastening the front leg fastener; the spade, consisting of a tube, plate, two handholds, and holes for the front leg lock. The plate has an opening for the supporting cams of the front legs.

#### FRONT LEG OF THE MOUNT

153. The front leg of the mount has a lug in which the lower surface of the fastener and the cam of the tip for connecting the leg in closed form with the back leg rests.

#### BASE OF THE MOUNT SEAT

154. The base of the mount seat consists of a tube and holes for securing the seat: two rear and one front.

#### MOUNT COLLAR

155. The mount collar has a pin, the upper end of which goes over the collar and is accommodated in the lug of the swivel so that the collar turns when the swivel turns. The pin has a rim to keep it from dropping out of the collar.



## UPPER TIPPING BASE

156. The upper tipping base has a handle, coupling bolts with plungers and springs which hold the nuts of the coupling bolts from spontaneous unscrewing during firing.

## MOUNT SHIELD

157. The mount shield (Fig.87) has an opening to the left of the cut-out for the body of the machine gun designed for firing with an optical sight. When firing with an open sight, this opening is closed by a flap.



Fig. 87. Shield:

- 1- cut-out for body of machine gun;
- 2- flap with handle

## INTERACTION OF PARTS AND MECHANISMS OF THE MACHINE GUN

158. Prior to charging the machine gun, the parts and mechanisms occupy the following position (Fig.88):

- the receiver is free of cartridges and the cover closed;
- the feed-lever of the receiver is in the forward position and not engaged with the bolt support lever;
- the ejector with rod and spring is in the rear position;
- the recoil stop roller of the bolt support is slightly depressed in its recess and the upper surface rests with its upper surface in the lower part of the receiver housing.

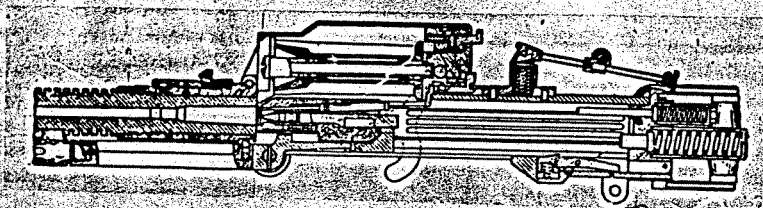


Fig. 88. Parts and mechanisms of the machine gun in the forward position

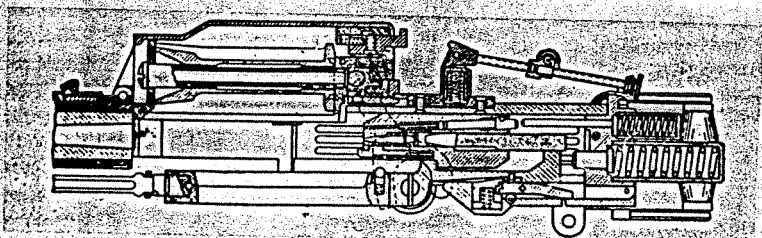


Fig. 89. Parts and mechanisms of the machine gun in the rear position

159. Charging the machine gun is performed in the following sequence:

- a) Set the safety in the "Stop" position.
- b) Open the receiver cover and raise it upward until it engages with the receiver stop.
- c) Fold back the belt support manually as far as it will go to the right.
- d) Place the loaded belt on the drum of the receiver so that the first cartridge lies in the upper recess of the drum. Hold the belt in the drum with the left hand. With the right hand, take the tip of the belt and pull the belt sharply to the right so that the drum with the cartridges turns  $1/3$  of a revolution ( $120^\circ$ ).
- e) Close the receiver cover.
- f) Using the charging handle ( or the bolt support lever), draw the movable system backward (Fig. 89). In so doing:



- the bolt support lever engages with the feed-lever and turns it;
- when the feed-lever turns, its tooth turns the receiver drum behind the ratchet by  $1/6$  of a revolution ( $60^\circ$ ); as a result of this, the cartridge is moved from the recess of the drum into the receiver opening of the receiver;
- the recoil stop roller is depressed by the back wall of the opening in the receiver housing, and passing through it, under the action of its spring, again rises upward; raising up of the recoil stop roller occurs after this as the bolt support advances approximately 20 mm backward from the forward position.

160. During firing, the parts of the machine gun execute the following operations:

a) The bolt, moving with the bolt support into the forward position, encounters a cartridge in the receiver opening of the receiver and feeds it into the cartridge chamber by means of the feed-rib. The cartridge slides on the end of the bullet along the slanted part of the drum recess, and then along the guide channel of the base of the receiver, and is guided into the cartridge chamber.

b) As the bolt support approaches the forward position, the counterrecoil roller encounters the counterrecoil block of the receiver housing, is depressed in the support and jumps across the block.

Under the action of its spring, the roller is lifted up and rests against the wall of the block on the inner side, keeps the support from recoiling at the moment of shooting.

c) When the movable system recoils, the hook of the extractor withdraws the cartridge case from the cartridge chamber. The ejector strikes with its back part on the bolt buffer, moves forward, strikes on the cartridge case and throws it through the lower opening of the bolt support downward.

161. Unloading the machine gun is performed in the following sequence:

- set the safety in the "Stop" position;
- open the receiver cover and lift it up until it engages with the receiver stop;
- remove the belt from the receiver drum;
- press on the catch of the receiver base and , drawing the receiver upward, pull the cartridges one after the other through the receiver opening of the

receiver base, turning the receiver drum with the feed-lever;

- turn the drum two or three times and make sure that there are no cartridges in it;
- make sure that there are no cartridges in the bore;
- holding the receiver in the hand, lower it;
- set the safety in the "Fire" position;
- lower the movable system with the sear notch of the bolt support.

## HANDLING THE MODEL 1938 MACHINE GUN

### DISASSEMBLY OF THE MACHINE GUN

162. Disassembly of the bolt is performed in the following sequence:

- a) Remove the extractor from the bolt:
  - using a small punch, drive the front end of the extractor spring upward;
  - extract the extractor spring with a wooden stick;
  - take out the extractor spring and remove the extractor;
- b) Separate the ejector from the bolt:
  - knock out the firing pin stud with a punch; when punching the stud, place the striker in the bolt frame in order to prevent the firing pin from springing out of the bolt frame channel;
  - remove the firing pin with spring.

163. Removal of the receiver from the receiver housing is performed in the following sequence:

- take out the pin of the receiver cover nut;
- unscrew the nut with a wrench;
- take out the receiver cover pin;
- remove the receiver from the receiver housing.

164. Disassembly of the receiver is performed in the following sequence:

- a) Remove the receiver cover.
- b) Separate the feed-lever from the base of the receiver;
  - unscrew the feed-lever screw;

- remove the feed-lever.
- c) Separate the tooth from the feed-lever:
  - knock out the pin of the feed-lever tooth;
  - remove the feed-lever tooth;
  - remove the spring of the feed-lever tooth.
- d) Separate the drum from the receiver base and disassemble it:
  - using a screwdriver, unscrew the pin of the receiver drum (the thread is left) and remove it;
  - press on the catch of the drum and remove it;
  - knock out the pin of the drum catch with a punch;
  - remove the drum catch and the drum catch spring.
- e) Disassemble the catch of the receiver base:
  - using a screwdriver, unscrew the backing screw of the catch and the receiver base;
  - remove the receiver base catch;
  - take out the spring of the receiver base catch.
- f) Disassemble the receiver cover catch:
  - unscrew the backing screw of the receiver cover catch;
  - remove the receiver cover catch;
  - take out the spring of the receiver cover catch.

g)

165. Removal of the barrel from the receiver housing is performed in the following sequence:

- unscrew the muzzle brake;
- with a wrench, loosen the barrel latch from the receiver housing and remove it;
- unscrew the barrel from the receiver housing; if the barrel will not unscrew, turn it until it moves from its place.

#### ASSEMBLY OF THE MACHINE GUN

166. Connecting the barrel with the receiver housing is performed in the following sequence:

- screw the receiver end of the barrel into the receiver housing as far as it will go, i.e., until the marks on the barrel and the receiver housing coincide

- set the barrel latch in the cross opening of the receiver housing;
- screw the muzzle brake onto the threading of the muzzle part of the barrel.

167. Assembly of the receiver is performed in the following sequence:

a) Assemble the receiver cover catch:

- set the receiver cover catch spring in the groove;
- install the receiver cover catch;
- using a screwdriver, screw the catch screw into the threaded recess.

b) Assemble the catch of the receiver base:

- set the spring of the receiver base catch in the groove;
- install the receiver base catch;
- using a screwdriver, screw the receiver base catch screw into the threaded recess.

c) Assemble the drum and connect it with the base of the receiver:

- install the drum catch spring;
- install the drum catch;
- install the drum catch pin;
- install the receiver drum in the middle part of the base of the receiver so that the opening of the drum coincides with the threaded recess for the drum pin;
- set the threaded part of the drum pin in the longitudinal opening of the drum and tighten the pin in the recess; first by hand, and then with a screwdriver.

f) Connect the tooth to the feed-lever:

- set the spring of the feed-lever tooth in the groove;
- place the feed-lever tooth in the cross opening for the pin;
- set the pin of the feed-lever tooth in the opening.

g) Connect the feed-lever to the base of the receiver:

- set the feed-lever in the opening of the receiver base;
- screw the feed-lever screw into the threaded opening.

h) Place the cover on the receiver.

i) Connect the receiver to the receiver housing;

- introduce the hinge lugs of the receiver base into the hinge lugs of the receiver housing.

cover, in so doing, aligning the openings for the receiver pin:

- put the hing lug of the receiver on the ear of the receiver housing;
- install the receiver cover pin from the right;
- lower the receiver onto the receiver housing;
- tighten the nut on the pin as far as it will go and align the opening of the pin under the pin with the slot in the nut;
- install the pin and spread its ends.

168. Assembly of the bolt is performed in the following sequence:

a) Connect the firing pin with the bolt:

- place the firing pin spring and firing pin in the lower channel of the bolt frame;
- install the pin in the opening of the bolt frame and fasten the firing pin and spring, for which, press on the firing pin with the striker so that the opening on the firing pin coincides with the opening for the bolt frame pin;
- check the correctness of assembly of the firing pin with the bolt frame; when pressing on the striker, the end of the firing pin must exit behind the surface of the base of the bolt frame recess, and when the striker is released, under the action of the spring, it occupies the initial position.

b) Connect the ejector with the bolt:

- place the ejector spring on the ejector;
- install the ejector from the back end of the bolt frame in the cylindrical channel of the bolt;
- install the ejector rod in the channel so that its opening is aligned with the opening of the bolt frame;
- install the ejector pin in the opening on the bolt frame and secure it.

c) Connect the extractor with the bolt:

- place the bolt frame on a wooden support with the feed-rib down;
- insert the extractor in the longitudinal groove of the bolt;
- set the extractor spring in the longitudinal groove.

With a blow of a wooden stick, send the spring until it goes behind the stop on the extractor.

169. Disassembly of the mount is performed in the following sequence:



- a) Remove the optical sight from the bracket.
- b) Drive the upper and lower bases of the mount to the right so that the hinge lugs of the inner screw of the fine aiming mechanism are removed from their pin located on the elevation base.
- c) Unscrew the limiting bolt from the bracket of the lower base; the limit
- d) Take the swivel from the base of the mount and remove the limiter:
  - withdraw the pin of the limiter clamp nut;
  - unscrew and remove the nut;
  - withdraw the bolt of the limiter clamp with lever;
  - unscrew the coupling of the limiter clamp;
  - remove the limiter from the base;
  - remove the clamping wedge;
  - remove the braking ring.

Further disassembly of the mount is performed in the ordnance workshop.

170. Assembly of the mount is performed in the reverse sequence to disassembly.

171. Replacement of a defective barrel is performed in the following sequence:

- a) Unload the machine gun.
- b) Disconnect the guide tube of the piston with the barrel.
- c) Separate the barrel from the receiver housing:
  - unscrew the barrel latch from the receiver housing with a wrench;
  - screw the new barrel into the receiver housing as far as it will go and secure it with the latch.
- d) Connect the guide tube of the piston with the barrel, seeing to it that its front part goes into the channel of the gas chamber regulator.

172. When using the gas regulator and when installing it, take the following into consideration:

- a) Machine guns issued to troop units have the regulator installed on the middle of the gas opening. The mark on the gas chamber has to be opposite the figure "4" of the gas regulator.



b) After firing 500-600 rounds, the movable parts of the machine gun acquire excess energy. This can be determined from the increasing rate of fire, from the forceful operation of the movable parts, and also from the forceful shooting out of the ejected cartridge cases. When firing under such conditions, premature wear is possible, and sometimes breakage of parts of the machine gun as well. In these cases, the regulator must be set on a lower gas opening (figure "2.8" on the gas regulator).

173. Switching the regulator of the gas chamber from a smaller to a larger opening is performed:

- if a machine gun which is completely serviceable, carefully cleaned and prepared for firing produces frequent stoppages caused by incomplete recoil of the moving parts into the rear position;
- in the event of severe fouling of the moving parts during firing when it is not possible to clean the machine gun.

Note. Follow the instructions in item 31 for resetting the regulator on the next gas opening.

#### TYPICAL MALFUNCTIONS CAUSING STOPPAGES DURING FIRING

174. In addition to the malfunctions causing stoppages during firing explained for the model 1938/46 machine gun, the following typical malfunctions may appear in the model 1938 machine gun:

Sequence No.	Description of stoppage	Cause of occurrence of stoppage	Means of elimination
1	2	3	4
1	<u>Wedging of cartridge belt with cartridges upon entry to receiver.</u>	1. Failure of bullet of cartridge to drop into recess on drum.	Recharge machine gun In event of repeat of stoppage:

Sequence No.	Description of stoppage	Cause of occurrence of stoppage	Means of elimination
1 contd.		2. Breakage or twisting out of belt link spring (in old model belts)	1. Fold back cover of receiver, remove belt, and remove wedged cartridge. 2. Remove pieces of broken belt link spring. Inspect nearest with cartridges and belt in box accordingly. Remove wedge cartridge from belt
2	<u>Bending of cartridge in receiver opening of receiver base.</u>	1. Wear or straightening of receiver base catch tooth. 2. Wear of upper surface of opening under catch tooth in receiver base.	Reload machine gun and continue firing. In the event of repetition of stoppage, unload machine gun, fold receiver back and repeat (if present) the malfunctioning catch with a serviceable one or send machine gun to ordnance workshop.
3	<u>Wedging of cartridge in receiver opening.</u>	1. Failure of drum of receiver to turn as result of:	1. Reload machine gun and continue firing

Sequence No.	Description of stoppage	Cause of occurrence of stoppage	Means of elimination
1	2	3	4
3 contd		<p>a) non-exit of tooth of feed-lever from its recess (camber of spring or tooth sticking in recess);</p> <p>b) empty jumping of drum catch over receiver ratchet (due to wear of drum stop tooth, depression of drum catch, or camber of spring).</p> <p>2. Weakening of seating of locking device on base of receiver.</p>	<p>In event of repeat stoppage:</p> <p>a) depressing the tooth of the feed-lever in recess with finger, check its operation (the movable system must be in forward position; in event of failure, replace tooth or its spring;</p> <p>b) check condition of drum catch and its tooth, replace catch if worn or broken.</p> <p>2. Fold back receiver and withdraw wedged cartridge. Tighten seating of locking device.</p>
4	<u>Non-feed of cartridges by receiver.</u>	1. Receiver drum fails to turn with incomplete recoil	1. Set movable system on sear notch and continue firing.

Sequence No.	Description of stoppage	Cause of occurrence of stoppage	Means of elimination
1	2	3	4
4 contd.		<p>of movable system of machine gun (missing a cartridge).</p> <p>2. Drum fails to turn as result of:</p> <p>a) wear of tooth of drum ratchet;</p> <p>b) wear of feed-lever tooth, camber of its spring or sticking of tooth in recess;</p> <p>c) wear of tooth of drum catch, camber of spring of drum catch or sticking of catch in recess.</p>	<p>2. Reload machine gun.</p> <p>In event of recurrence of stoppage:</p> <p>a) check condition of feed-lever frame and normal feed of drum and feed-lever tooth; if tooth is defective, replace it with spare; in event of repeated stoppage, send machine gun to workshop and install new ratchet;</p> <p>b) depressing tooth of the feed-lever in the recess with the thumb; check its operation (movable system be in forward position); if tooth is defective, replace them;</p> <p>c) check condition</p>



Sequence No.	Description of stoppage	Cause of occurrence of stoppage	Means of elimination
1	2	3	4
4 contd.			off drum catch and its tooth; replace if defective.
5	<u>Bending of cartridge on entry into cartridge chamber.</u>	Cartridge stop operates insufficiently energetically.	Reload machine gun and continue firing. In event of repeated stoppage: swing rear back, withdraw cartridge, drawing movable system back by handle, and continue firing.
6	<u>Through piercing of cartridge primer.</u>	<ol style="list-style-type: none"> <li>1. Excess extension of firing pin beyond front surface of base of bolt seat.</li> <li>2. High anvil of cartridge case (a cartridge defect).</li> <li>3. Crumbling or breakage of firing pin, and also its incorrect shape.</li> <li>4. Wear or erosion of opening in bottom of bolt seat.</li> </ol>	<p>Reload machine gun and continue firing. In event of repeated stoppage:</p> <ol style="list-style-type: none"> <li>1. Replace unserviceable firing pin or bolt.</li> <li>2. Remove unserviceable cartridge from belt.</li> <li>3. Replace firing pin.</li> <li>4. Clean carbon and fouling from bolt.</li> </ol>

Sequence No.	Description of stoppage	Cause of occurrence of stoppage	Means of elimination
1	2	3	4
6 contd.			seat. Replace serviceable ridge
7	<u>Primer drops out of cartridge during firing</u> (Primer is pressed in the opening in bottom of bolt frame seat). <u>Note.</u> Stoppage occurs with next round.	Stoppage occurs as a result of cartridge defect or erosion of opening for firing pin in bolt.	Reload machine Withdraw the primer which dropped from cartridge case (failure to re primer can cau jamming of mov system and fai to fire).
8	<u>Spent cartridge case is caught by bolt support.</u>	1. Insufficiently forceful recoil of movable system as result of: a) presence of burrs, big scratches, or fouling on parts of machine gun in contact; b) presence of considerable carbon on gas tracts.	Reload machine and continue firing. In event of re stoppage: 1. Swing recei back, draw mov system backward and withdraw c cartridge case under bolt sup and the live c ridge from the ridge chamber.



Sequence No.	Description of stoppage	Cause of occurrence of stoppage	Means of elimination
1	2	3	4
8 contd.		<p>2. Unserviceability of extractor, its spring, or the ejector.</p> <p>3. Wear of bolt frame seat.</p>	<p>Send the movable system forward, lower the receiver reload machine gun and continue firing.</p> <p>In event of repeat stoppage:</p> <p>a) remove fouling and eliminate mechanical damages;</p> <p>b) clean carbon off gas tracts.</p> <p>2. Replace extractor or bolt.</p> <p>3. Replace ejector or bolt.</p>

#### INSPECTION OF THE MACHINE GUN IN ASSEMBLED FORM

175. Check the connection of the barrel with the receiver housing. The connection of the barrel with the receiver housing is considered correct when:

- the barrel is screwed into the receiver housing as far as it will go, is firmly secured and tightened by the latch, and the mark on the barrel is aligned

with the mark on the receiver housing;

- the barrel, connected with the receiver housing and secured by the latch, has no longitudinal tilting and revolution.

176. Check the condition of the gas chamber regulator. The gas chamber regulator is considered serviceable when:

- the regulator is firmly secured in the gas chamber, the regulator nut is tightened and secured by the pin;
- the mark on the face of the regulator coincides with the mark of the gas chamber and is set on the required figure.

177. Check the correctness of assembly of the receiver, the reliability of its operation, and reliability of fastening to the receiver housing. The receiver is considered serviceable when:

- when the bolt support recoils as far as it will go in the rear position, the drum turns  $1/6$  of the circumference;
- when the feed-lever is moved into the forward position, the feed-lever stop keeps it reliably in the forward position;
- the feed-lever has no deflection; there is a gap between the feed-lever and the receiver housing;
- the pin of the receiver drum is turned as far as it will go, and the receiver drum turns on its pin freely and without sticking;
- the ratchet of the drum fits tightly on the drum and is reliably secured;
- the receiver drum turns under the action of the feed-lever tooth when the feed-lever is brought backward, and the catch of the drum drops into the corresponding opening on the ratchet of the drum;
- when the feed-lever is carried forward, the feed-lever tooth jumps across into the next recess of the drum ratchet; the feed-lever tooth does not get stuck in its recess; the feed-lever, located in the extreme rear position, does not strike against the base of the receiver;
- when disengaged from the catch, the receiver is freely lifted up by hand, and when lowered, the catch reliably engages with the base of the receiver.

- vertical motion of the receiver fastened on the receiver housing by the catch does not exceed 0.2-0.6 mm;
- the catch of the receiver cover sinks freely into its recess when pressed with the finger; the receiver cover swings upward freely;
- the feed-lever stop is firmly attached and has no motion;
- there is a gap of 0.8-1.0 mm between the cartridge selector and the cartridge lying in the recess of the drum.

178. Check the rear sight. The rear sight is considered serviceable when:

- with pressure on the clamp, the elevating slide moves smoothly along the sight leaf and is firmly held by the motion screw on any graduation of the sight leaf scale;
- the motion screw of the backsight and the backsight on machine guns manufactured prior to 1942 are not bent and work correctly.

179. Check the correctness of action of the recoil stop roller of the bolt support.

Operation of the recoil stop roller of the bolt support is considered correct when, as the bolt support approaches the forward position, the roller is pressed under the action of its spring by the upper surface against the receiver housing, and jumping across the back wall of the block in the receiver housing, keeps the bolt support from recoiling.

The correctness of operation of the recoil stop must be carefully watched since the recoil of the bolt frame during a hangfire can lead to explosion of the cartridge in the receiver housing and to damage to the machine gun.

180. Check the operation of the traversing limiter. The traversing limiter is considered serviceable when:

- the limiter is released when the clamp lever is turned away from you and makes it possible to turn the body of the machine gun to the left and right;
- the limiter is secured when the clamp lever is turned toward you and limits turning of the body of the machine gun to the left and right.

181. Check the operation of the fine elevating mechanism and the sight ring. The fine elevating mechanism and the sight ring are considered serviceable when:

- the inner screw of the fine elevating mechanism is completely screwed into the outer, and the indicator window of the sight ring is on the left;
- with the unfastening of the fine aiming clamp and with turning of the knob, the inner and outer raising screws raise or lower smoothly without jumping and considerable friction;
- the outer screw does not turn in it when the bolt of the elevating mechanism is secured;
- with rotation of the knob of the outer raising screw, the sight ring turns together with it; the ring turns freely when it is turned by hand;
- the indicator of the sight ring does not hinder rotation of the ring

182. Check the action of the front leg fastener. The front leg fastener is considered serviceable when:

- with release of the fastener, the legs of the mount are released and freely spread to the side (when the machine gun is set for firing on aerial targets);
- with the fastener secured, the legs of the mount are reliably secured and prevented from spreading aside (when the machine gun is set for firing on ground targets).

#### INSPECTION OF THE MACHINE GUN IN DISASSEMBLED FORM

183. Inspect the barrel. The barrel is considered serviceable when:

- there are no nicks, cracks, and other damages on the band thread of the barrel stub and on the surface of the groove for the barrel latch to hinder screwing the barrel into the receiver housing;
- the smooth cylindrical part which serves to guide the barrel into the receiver housing has no scratches and nicks to hinder entry of the barrel into the receiver housing.

184. Inspect the barrel latch. The barrel latch is considered serviceable when:

- the cylindrical threaded shank for screwing the latch into the cross opening in the receiver housing and the hexagonal head for the wrench do not have crumbling and dents;

- the barrel latch screws freely into the threaded cross opening in the receiver housing and with a correctly screwed in barrel, holds it firmly in the assigned position.

185. Inspect the receiver housing. The receiver housing is considered serviceable when:

- the band threading for connection with the barrel has no dents, fouling, and other damage;

- the recoil block is reliably pressed into its recess and does not have metal cuts and other damage.

186. Inspect the bolt and its parts. The bolt and its parts are considered serviceable when:

- the extractor hook and its spring do not have dents, burrs, and enter the corresponding groove in the bolt frame and are reliably held by the pin during assembly;

- the ejector, spring, and rod of the ejector do not have bends, dents, and freely enter the longitudinal channel of the bolt and are reliably held by the pin during assembly;

- the firing pin is not crumbling, is not bent and twisted, and its spring does not have camber or break.

187. Inspect the bolt support. The bolt support is considered serviceable when:

- the recoil stop roller of the bolt support works correctly under the action of the spring and, when pressed with the finger, returns forcefully to the previous position;

- the threading of the rod and the recess in the bolt support do not have nicks, metal crumbling, and scratches;



- the bolt support is firmly connected with the rod.

188. Inspect the back plate. The back plate is considered serviceable when:

- the bolt buffer is not bent and there are no nicks and metal crumbling on its front surface;
- the bolt buffer tube is turned as far as it will go and its pin is reliably secured

189. Inspect the receiver. The receiver is considered serviceable when:

- the feed-lever is not bent;
- the ratchet does not have play in respect to the receiver;
- the springs of the catch and the tooth of the feed-lever are serviceable;
- there are no nicks, dents, and other damages on the lugs and threads of the grooves of the receiver;
- the cartridge stop and locking device, the feed-lever stop, the cartridge selector, the base of the catch of the receiver cover, and the washers of the hinge lugs of the receiver cover do not have play, dents, cracks, and other damages;
- the feed-lever of the receiver seats firmly in the base of the receiver;
- the pin of the drum is turned as far as it will go and is firmly secured.



## PART II

### ANTIAIRCRAFT SIGHTS, MODEL 1943, 1938, AND 1941 FOR 12.7-mm MACHINE GUNS, MODEL 1938/46 AND MODEL 1938

#### CHAPTER X

##### ANTIAIRCRAFT SIGHT, MODEL 1943

###### COMBAT PROPERTIES AND FUNCTION OF THE ANTIAIRCRAFT SIGHT, MODEL 1943

190. The antiaircraft sight, model 1943, is designed for aiming the machine gun when firing on aerial targets flying at speeds up to 550 km/h at ranges up to 1600 m.

191. The antiaircraft sight, model 1943, for firing on aerial targets is mounted<sup>3</sup> on the model 1938/46 and model 1938 12.7-mm machine guns on the model 1938 universal mount.

Weight of the antiaircraft sight without case is 2 kg.

###### MAIN PARTS OF THE ANTIAIRCRAFT SIGHT

192. The main parts of the model 1943 antiaircraft sight (Fig.90) are: front sight; tracking sight; connecting shaft; rear sight; collar, and intermediate bracket. Accessories are assigned to the sight. The sight is stored and transported in a case. The collar and intermediate bracket are used for fastening the sight on the model 1938 machine gun.

The front sight (Fig.91) is used for aiming the machine at the target. It consists of the sight frame, handle, and a ring with a sight scale.

The sight frame has a roller with pins for controlling the turning of the ring, a tube with clamp for connection with the tracking sight, a bracket for connection with the intermediate bracket, posts with openings for passage of the shaft, and handles and rods with a bushing for the connecting shaft. The bushing

has grooves for the connecting shaft pin. The post is fastened on the frame with screws. A mark is made on the inner surface of the frame from below for installing the ring when assembling the sight.

The handle is mounted in the opening of the posts of the frame. It has a folding grip for rotating and a shaft with gears. The gears turn the ring.

The ring has teeth around the circumference for engaging the gear teeth. Inside the ring, a scale with 10 openings is attached on a radius of the ring. Each opening corresponds to one sight graduation. For convenience in reading, the even graduations are marked with the corresponding number of notches. For example, the second ring (not counting the central one) has two notches (one right and one left), the fourth - has four notches, and so forth. The odd graduations have no notches. The sight scale is held in the ring with two stretched braces. The ring has a groove outside along which the rollers of the sight frame slide. A table of graduations is mounted on the face of the frame.

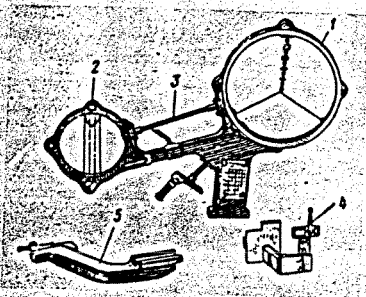


Fig. 90. General view of antiaircraft sight, model 1943:

- 1- front sight; 2- tracking sight;
- 3- connecting shaft; 4- rear sight;
- 5- intermediate bracket for 1938 model.

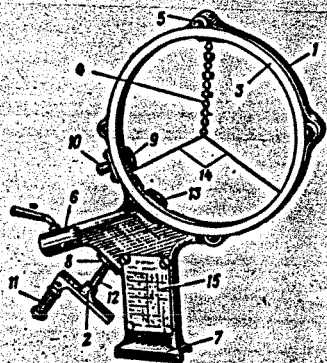


Fig. 91. Front sight:

- 1- frame; 2- handle; 3- ring;
- 4- sight scale; 5- rollers;
- 6- tube with clamp; 7- bracket;
- 8- post; 9- connecting shaft gear;
- 10- grooves; 11- folding grip;
- 12- shaft; 13- gear; 14- stretched brace; 15- tablet.

193. The tracking sight (Fig.92) is used to set the sight scale parallel to the movement of the aircraft and also for checking on its position. It consists of a frame and a ring with tracking sighting strings.

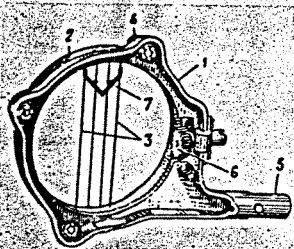


Fig. 92. Tracking sight:

1- frame; 2- ring; 3- tracking strings;  
4- roller; 5- shank; 6- gear with  
bushing; 7- arrow ( a model aircraft  
in later issue sights)

The tracking sight frame has rollers with pins for directing the rotation of the ring, a shank with a bushing for connection with the tube of the front sight, and a gear with a bushing which fits in the post. The gear bushing has grooves for the shaft pin. The post is mounted on the frame with screws. A mark is inscribed on the inner surface of the frame for installing the ring in the frame when assembling. The ring has teeth around its circum-

ference for engaging the gear teeth. Inside the ring there are four tracking strings. An arrow is fastened to the tracking strings. The tracking strings are used for setting the sight scale parallel to the movement of the aircraft and for checking its position. The arrow on the strings is set according to the course of the aircraft.

The ring has a groove outside along which the rollers of the frame slide. A mark is made inside the ring for installing it in the frame when assembling.

194. The connecting shaft (Fig.93) serves to transmit the rotation of the front sight ring to the tracking sight whereby parallelism of the sight scale and tracking strings is ensured. There are pins on the ends of the shaft, which enter the grooves of the gear bushings of the front and tracking sights.

When assembling the sight, the connecting shaft is installed only after this, as the sight scale is set parallel to the tracking strings, i.e., the sight and tracking rings are installed according to the marks on their frames.



Fig. 93. Connecting shaft:  
1- pins

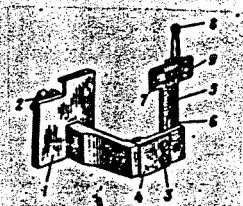


Fig. 94. Rear sight:  
1- bracket; 2- plate; 3- screw;  
4- removable plate; 5- post; 6- lower  
slot; 7- upper slot; 8- peep hole;  
9- screw with washer

The collar has an upper part, the "dovetail" with a clamp for the intermediate bracket, a lower part connected with the upper by means of a pin, and a removable bolts with pin and nut for mounting the collar on the machine gun

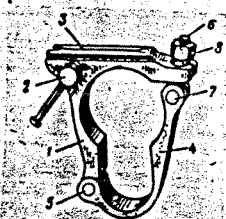


Fig. 95. Collar:  
1- upper part; 2- clamp; 3- dovetail;  
4- lower part; 5- pin; 6- removable bolt;  
7- bolt pin; 8- nut

195. The rear sight (Fig. 94) together with the front tracking sights serves for aiming the machine gun at the target. It has a bracket with a plate and a screw with a wing nut for fastening to the ground sight on the frame. The removable plate with spring is mounted on the front part of the bracket. The peep-hole post is mounted on the removable plate with a screw. The peep-hole post has a slot below for adjusting the height of the peep hole, and a slot above in which the peep hole is mounted with a screw and washer.

196. The collar (Fig. 95) is used for mounting the antiaircraft sight on the model 1938 machine gun.

197. The intermediate bracket (Fig. 96) serves to reduce the length of the sighting line to 340 mm when the sight is mounted on the model 1938 machine gun. It has a groove for connection with the collar and a projection in the form of a dovetail with a clamp for connecting with the front sight

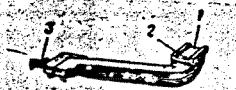


Fig. 96. Intermediate bracket:

1- groove; 2- lug; 3- clamp

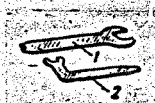


Fig. 97. Accessories:

1- wrench; 2- wrench-screwdriver

198. The accessories (Fig. 97) consist of two wrenches designed for assembly and disassembly of the sight.

199. The case (Fig.98) consists of a wooden box with cover which is closed with a sliding lock. A handle made of tape is used for carrying. Special recesses are mad in the case for storing all the parts of the antiaircraft sight.

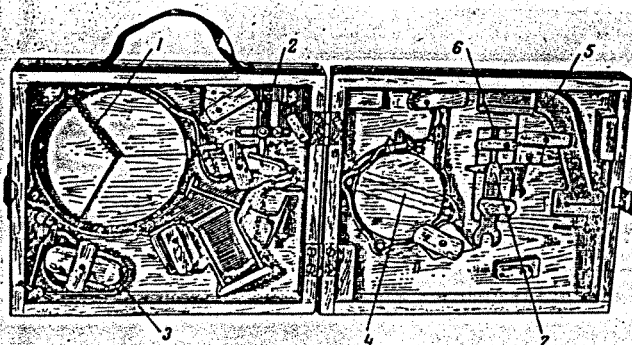


Fig. 98. Packing the model 1943 antiaircraft sight in the case:

1- front sight; 2- rear sight; 3- collar; 4- tracking sight; 5- intermediate bracket; 6- shaft; 7- wrenches



## ASSEMBLY AND DISASSEMBLY OF THE ANTI-AIRCRAFT SIGHT ON THE MACHINE GUN

200. Assembly of the anti-aircraft sight on the machine gun is performed in the following sequence:

- place the rear sight on the frame of the ground sight and secure it with the plate;
- set the shank of the frame of the tracking sight in the tube of the frame of the sight by half of its length;
- turn the sighting and tracking rings so that the mounting marks on the rim coincide with the marks on the frames of the sighting and tracking sight;
- move the frames of the tracking sight and the sight so that the second end of the connecting shaft goes into the bushing of the gear of the tracking sight, and the setting pin on the shank of the tracking sight frame goes into the slot of the sight frame tube; secure the front sight tube with the clamp;
- set the intermediate bracket in the bracket of the front sight; push the intermediate bracket into the groove of the receiver housing and secure it with the pin.

Note. When installing the sight on the model 1938 machine gun:

- put the collar of the anti-aircraft sight approximately 460 mm from the frame of the ground sight and lightly fasten the collar; washers may be used in order to get a better fit of the collar;
- connect the intermediate bracket with the sight and tighten the pin;
- set the sight on the collar and tighten the pin;
- final fastening of the collar on the machine gun is made when adjusting the sight.

201. Disassembly of the anti-aircraft sight is performed in the following sequence:

- loosen the pin and remove the sight from the receiver housing;
- separate the intermediate bracket from the sight frame;
- loosen the clamp and remove the tracking sight from the sight frame; simultaneously remove the connecting shaft;
- fold up the sight handle;



- place the sight in the case;
- remove the rear sight from the machine gun.

Note. When removing the sight from the model 1938 machine gun, take off the sight from the collar and remove the intermediate bracket. The collar, as a rule, is not removed from the machine gun.

It is not permitted to use strong force or blows when assembling or disassembling the sight.

## OPERATING THE SIGHT

202. The model 1943 sight is operated by two crew members: the gunner and the tracker.

The tracker during firing observes the target through the tracking sight. Operating the handle, he continuously turns the tracking strings so that they are constantly parallel to the direction of flight of the target, i.e., the axis of the fuselage of the aircraft. In so doing, the target may or may not agree with the tracking string.

The point of the arrow on the tracking strings must be directed in the direction of movement of the aircraft. When the gunner aligns the target with any graduation on the scale, then the movement of the aircraft will appear to be directed into the center of the ring, but in reality, the direction of its movement intersects the flight trajectory of the bullet.

203. The gunner aims the machine gun at the target according to one of the graduations on the sight scale. He fires in long or short bursts. When aiming, the gunner looks through the peep hole of the rear sight and aligns the target with one of the graduations of the sighting scale.

Determination of the required sight graduation is made from the "Graduation Table" which is placed on the face of the sight frame.

Graduation scale for the 12.7-mm machine guns,  
models 1938 DShK and 1938/46

1 Скорость цели км/час	Дальность, м 2					
	1800—1200		1200—600		600—200	
	Рыкание 3					
	1/4	2/4	1/4	2/4	1/4	2/4
	Деления 4					
До 300 5	2	4	2	3	2	3
300—400	3	5	2	4	2	4
400—500	3	6	3	5	2	4

Key: (1) Target speed, km/h; (2) Range, m; (3) Aspect ratio; (4) Graduations;  
(5) Up to

The graduation table is compiled for:

- three groups of speeds with accuracy up to 100 km/h;
- three groups of ranges with accuracy up to 600-400 m;
- four aspect ratios with accuracy up to 1/4 circumference.

For each of the possible combinations of speed, range, and aspect ratio, a number of the required graduation of the sighting scale is determined. In a number of cases, the numbers of graduation are given rounded off to the high side.

The graduations for a 3/4 aspect ratio are obtained by simple addition of the graduation numbers for 1/4 and 1/2. For example: the target is flying at a speed of 400 km/h at a range of 1000 m. Aspect ratio is 3/4. From the table find the graduation in the 400-500 line on the table for aspect ratio 1/4 the graduation 3 and on the table 2/4 - the graduation 5. Add 3+5 = 8. Give the command "Mark 8".

The graduation for 4/4 aspect ratio is found by doubling the graduation number for 1/2 aspect ratio.

In this way, the the graduations for 1/2 aspect ratio are the basic ones.

The graduations for 1/4 aspect ratio included in the table can be obtained by dividing the number of the basic graduation (for 1/2 aspect ratio) in half.

In those cases when the graduation numbers are obtained as fractions, they are rounded to the nearest whole number on the high side.

The graduation table is placed on the sight only for reference. The commander and gunner must know the graduation table by heart. Before commencing firing the commander must check the knowledge of table data for  $1/2$  aspect ratio.

204. The angle of sight in the model 1943 antiaircraft sight is taken as constant for average range and average angle of elevation since an error in angle of sight is small in comparison with errors arising from other causes. The angle of sight is established when adjusting the sight.

205. Adjustment of the sight is made when it is mounted on the model 1938 machine gun in the following sequence:

a) Using the scale ruler, set the front sight at a distance of 340 mm (with a tolerance of 3 mm) from the rear sight.

Measurement is made with the scale ruler from the front rim of the peep hole of the rear sight to the rear rim of the central bushing (the zero mark of the sight) of the front sight. This distance is called the sighting line. A change in the size of this line is produced by moving the collar on the machine gun. After the sight is adjusted, a mark is made on the circumference of the barrel at the forward part of the collar in order to ensure rapid mounting and adjustment of the sight in the future.

Secure the collar on the machine gun.

b) Set the ground sight on the figure 9 (900 m).

c) From the ground sight, aim the machine gun at a point no less than 400 m away from it.

d) By shifting the peep hole of the rear sight, direct the zero sighting line at this same point.

e) After this, tighten the screws securing the peep hole. When slowly turning the sight scale  $360^\circ$ , the aiming must not be knocked off.

Note. Points "b", "c", "d", and "e" also apply to the model 1938/46 machine gun.

206. The correctness of adjustment is checked no less than once a day, and in addition, after transfer, transport, and disassembly of the machine gun, and also after field firing.

207. When operating the model 1943 antiaircraft sight, the gunner and the tracker may correct one another, since it is evident to the gunner when the tracker sets the tracking strings non-parallel with the movement of the aircraft, and it is evident to the tracker, when the gunner opens fire, that the aircraft is not aligned with the sight scale.

208. During firing, individual cases are possible where the scale number proves to be higher than 10. In this case, the aiming point must be carried to the limits of the ring along a line of continuation of the scale a distance corresponding to the graduation obtained.

209. Firing on aircraft is conducted with tracking fire or with a curtain of fire.

210. Adjustment of fire is made only according to the flight of tracer bullets. With correct operation by the crew and when firing with adjusted sight, only leading or trailing tracks can be obtained if errors were permitted in determining aspect ratio, firing range, and target speed. These errors are corrected to a considerable degree by parallel barrage ("waiting") fire. In the event of sizable errors (more than two graduations) fire is corrected by changing the scale graduation for aiming. Correction is made from the calculation that the value of one graduation of the sighting scale is equal to  $1^{\circ} 20'$  or about 0-23 (this corresponds approximately to 5 small graduations on the range reticle of the binoculars).

#### STORAGE AND CARE OF THE ANTI-AIRCRAFT SIGHT

211. When transferring or transporting the machine gun, the antiaircraft sight is removed and placed in the case.

212. After firing and before placing in the case, the sight is cleaned. Moisture, sand, and dust are wiped off with a clean cloth or patch.

213. The sight is periodically lubricated with a thin layer of rifle grease to prevent rusting. In so doing, attention must be paid chiefly to seeing to it that parts in contact are lubricated: the bearings of the gears and shafts and also the pins of the rollers.

#### ASPECT RATIO -RANGE FINDER AND ITS OPERATION

214. The aspect ratio-range finder (Fig. 99) is used for approximate determination of aspect ratio and range.

215. The aspect ratio-range finder consists of a frame with a table of graduations, a cord, arrow, and a model aircraft with a small drum.

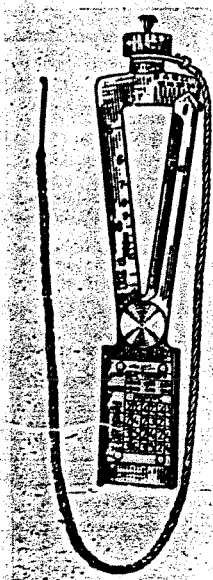


Fig. 99. Aspect ratio-range finder

216. Determination of range is made from the length of the fuselage or from the wingspan of the aircraft depending on target visibility. Both the length of the fuselage and the wingspan are determined according to the type of aircraft, which is established from the scale with the aid of the arrow. The size of the gap between the frame and the arrow is adjusted in proportion to the length of the fuselage or the wingspan.

217. Operation of the aspect ratio-range finder is performed in the following sequence:

a) With the hook on the cord of the range finder, fasten it behind the clasp of the collar of the overcoat or the buttonhole of the blouse in such a way



that the distance from the eye to the range finder with a tight cord is approximately equal to 650 mm (error no greater than 30 mm is tolerated).

b) Set the model aircraft depending on which method of measuring is used (according to length of fuselage or according to wingspan).

c) Determine the length of fuselage or wingspan for the type of aircraft in meters and set the value obtained according to the upper scale with the tip of the upper end of the arrow.

Note. The operations described in items "a", "b", and "c" are preparatory.

d) Turn the whole aspect ratio-range finder so that the model aircraft becomes parallel to the movement of the aircraft. From the small disk held in place by the tightened cord, count off the amount of aspect ratio; if necessary, round to the nearest quarter.

e) Holding the aspect ratio-range finder in the same position, i.e., maintaining parallelism of model aircraft and target, place the visible target in the space between the frame and the arrow. The nearest figure on the frame will correspond to the range to the target.

f) From the measured range and aspect ratio, take the necessary graduation from the table and give it in an order to the gunner.



## CHAPTER XI

### CONSTRUCTION OF THE ANTI-AIRCRAFT SIGHT, MODEL 1938

#### ANTI-AIRCRAFT SIGHT, MODEL 1938 FOR 12.7-mm MACHINE GUN, MODEL 1938

##### PURPOSE AND BASIC SPECIFICATIONS OF THE ANTI-AIRCRAFT SIGHT

218. The model 1938 anti-aircraft sight is a ring range sight (Fig.100). It is used for aiming the machine gun when firing on aerial targets moving at speeds up to 500 km/h at ranges up to 2400 m, and permits firing on ground targets with the shield removed.

219. The initial data for firing on aerial targets are range to the target and target speed.

The initial data are determined in the following manner:

- range to the target is determined with a special range finder or with the eye; ranges are established from the scale of the range ruler by moving the carriage with the front ring sight until alignment of the corresponding graduation of the scale with the indicator;
- target speed is determined by the eye, according to type of aircraft, and the ring corresponding to this speed (or the space between rings) is selected.

220. When the initial data are set on the sight the following problems are solved automatically:

- the angular lead is constructed, i.e., a correction is given for straight-line movement of the target for the time of flight of the bullet until it meets the target;
- an angle of elevation is constructed corresponding to range to the target;
- the angle of elevation is changed, depending on the angular altitude.

221. The machine gun on the 1938 model mount has an invulnerable cone ( $24-10^\circ$ ).

The maximum angle of elevation with the breech part of the machine gun between the legs of the mount equals  $85^{\circ}$ , and when it is positioned opposite the legs - about  $78^{\circ}$ .

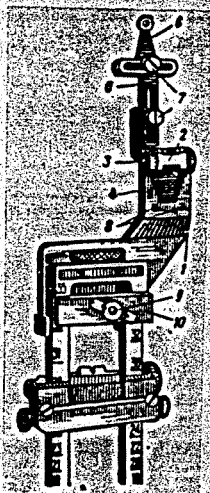
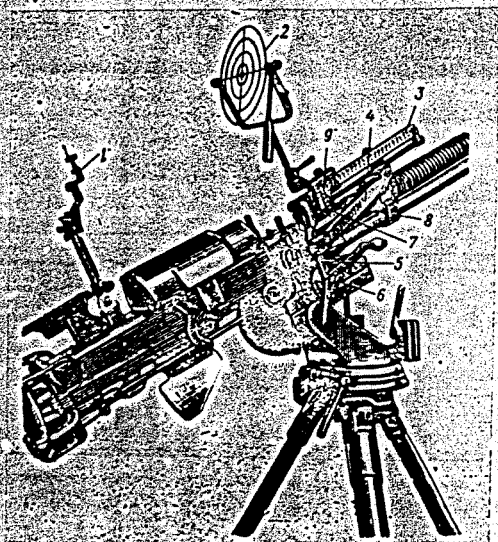


Fig. 100. General view of model 1938 antiaircraft sight on machine gun;  
 1- rear sight; 2- front sight;  
 3- range ruler; 4- upper bracket;  
 5- rod; 6- drive with handle;  
 7- bracket-seat; 8- collar;  
 9- carriage

Fig. 101. Rear sight;  
 1- large bracket; 2- small bracket; 3- pin; 4- plate spring; 5- peep-hole holder;  
 6- peep hole; 7- screws for fastening peep-hole holder;  
 8- screws for fastening plate spring; 9- wing nut; 10- plate for securing rear sight

#### CONSTRUCTION OF THE ANTIAIRCRAFT SIGHT

222. The antiaircraft sight consists of a rear sight, front ring sight, range ruler, upper bracket, elevating nut, lower bracket-seat, collar, rod, and drive.

## REAR SIGHT

223. The rear sight (Fig.101) is set on the base of the large bracket on the sight frame and secured with a wing nut.

The rear sight consists of a large bracket, small bracket, pin, plate spring, peep-hole holder, peep hole, screws for fastening the peep-hole holder, washers, screws for fastening the plate spring, a wing nut and plate for securing the rear sight to the sight frame.

The peep hole moves in the horizontal plane and is fastened to the peep-hole holder by a screw. The peep-hole holder moves in the vertical plane and is fastened to the small bracket by a screw. The peep hole and holder are moved when adjusting the sighting line.

The large and small brackets are connected to one another by a hinge with a pin. When the sight is lowered, the brackets fold. The small bracket is held in the closed or extended position by the plate spring which is fastened to the large bracket by two screws. When the screws are tightened, the the peep hole and the rear sight bracket are held securely on the sight frame.

When the rear sight is removed from the sight frame, the wing nut together with the plate must again be screwed into the threaded opening for it in the large bracket.

The plate spring firmly holds the small bracket with the peep hole in the plane of the sight frame.

With the rear sight mounted on the sight frame, fire can be conducted on ground targets at ranges up to 3200 m.

## FRONT RING SIGHT

224. The front ring sight (Fig.102) consists of a ring sight, post with a yoke, and a weight bob.

The ring sight has four concentric rings connected by four spokes and a hub.

The hub of the ring sight with a diameter of 12 mm is intended for firing on ground targets; its center is used for adjusting the antiaircraft sight.

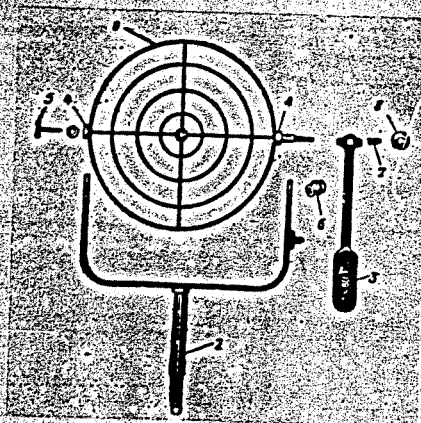


Fig. 102. Front ring sight:

- 1- ring sight; 2- post with yoke;
- 3- weight bob; 4- spindles;
- 5- screw-pin; 6- nut-bearing;
- 7- spring; 8- nut

ary circumference standing off from the outer ring a distance equal to the space between the rings.

The outer ring has two spindles. The left spindle turns on the shank of a screw-pin. The right spindle turns on a nut-bearing and has threading on the end for screwing on a nut, and a square in the middle part.

A cylindrical spring is placed on the end of the right spindle, which, by bearing on the nut, holds the weight bob on the square.

The front ring sight turns freely on the spindles. With hand pressure on the arm of the weight-bob, and when stopped by the thumb on the nut, the weight bob is removed from the square of the right spindle. When it is turned  $90^\circ$  in relation to the plane of the rings, it again engages on the square.

The spokes of the rings are mutually perpendicular and held firmly by the rings.

The post with the yoke holds the front ring sight. The post and yoke make up a single unit. The post is mounted in the holder of the ring sight on

The rings are designed as follows:

- the first, with diameter of 45 mm, for firing on aerial targets moving at a speed of 100 km/h;
- the second, with diameter of 90 mm, - for firing on aerial targets moving at a speed of 200 km/h;
- the third, with diameter of 135 mm, for firing on aerial targets moving at a speed of 300 km/h;
- the fourth (outer), with diameter of 180 mm, - for firing on aerial targets moving at a speed of 400 km/h.

When firing on aerial targets moving at a speed of 500 km/h, aiming is performed according to the image

the sight carriage. There is a limiting slot on the end of the post which limits turning of the post. Threaded openings are made on the ends of the yoke. An adjusting screw-pin is screwed into the left opening, and a nut-bearing into the right one. The holder of the weight-bob is fastened to the right branch of the yoke outside.

Before a march, the front ring sight must be removed from the machine gun and placed in the case.

When installing the front ring sight, set the end of the post in the recess of the holder and tighten with a screwdriver.

The weight-bob holds the ring sight in a horizontal position. The lower end of the weight-bob is thickened. The thickened part of the weight-bob of the new model is cylindrical, strictly rectangular. There is a square opening in the upper end of the weight-bob through which the square of the right spindle of the ring sight passes.

The weight-bob is introduced into the yoke of the holder in order to hold the ring sight in a position perpendicular to the range ruler.

#### RANGE RULER, BRACKET, JACK NUT, AND COLLAR

225. The carriage with the front ring sight moves along the range ruler (Fig.103) by means of a motion screw. There is a scale with figures from 4 to 24 on the range ruler. The graduations correspond to ranges to the target of 400 to 2400 m.

The range ruler with the scale is used for determining the position of the front ring sight relative to the rear sight.

When firing at ranges less than 400 m, the carriage with the ring sight is set on the figure "4". The front, tapered face of the carriage serves as an indicator of range for the range ruler. The face is designed for best visibility of the figures with the carriage set on the ruler. The carriage with ring sight is moved along the range ruler by means of the drive with handle.

The range ruler is fastened by the back end to the rod, and by the front end to the upper bracket by the jack nut, the ruler bracket, nut, and lock nut.



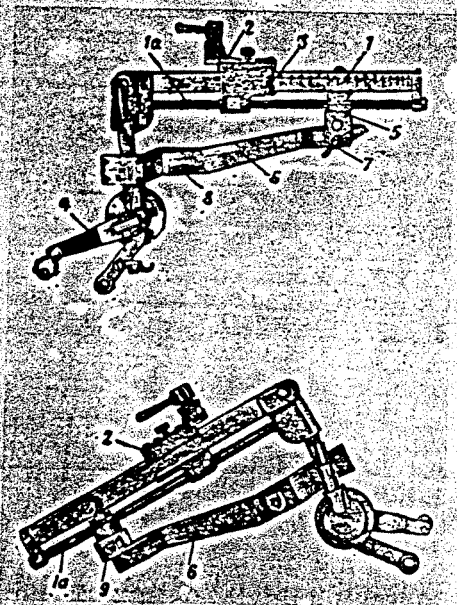


Fig. 103. Range ruler:

- 1- range ruler; 1a- motion screw;
- 3- carriage; 4- drive with handle;
- 5- jack screw; 6- ruler bracket;
- 7- wing nut; 8- screw; 9- lug with groove

used to prevent spontaneous loosening of the nut after the antiaircraft sight has been adjusted.

228. The lower bracket-seat (Fig.104) is used to fasten the upper bracket.

In the rear part of the bracket-seat there are lugs which are inserted in the vertical grooves on the front part of the receiver housing when the bracket-seat is mounted on the machine gun. The front end of the bracket-seat is fastened to the machine gun with a collar.

226. The upper bracket secures the ruler and the parts on it to the lower bracket by means of a wing nut and screw which are screwed into the threaded recess of the upper bracket.

There is a lug with a groove in the form of a dovetail in the front part of the upper bracket over which the jack nut moves. A groove is made in the upper bracket, covered by the plate, for the passage of the rod.

227. The jack nut is used for moving the range ruler with ring sight in a lateral direction when adjusting the antiaircraft sight. A nut enters the jack which is secured by a pin. The pin enters the annular slot of the nut. It holds the nut from vertical movement, giving it the capability of turning freely in the jack.

When the nut turns, the bracket moves in the vertical plane. The bracket cannot turn since it, together with the nut, is held by the hinge lug which is connected with the pin of the range ruler. The lock nut is



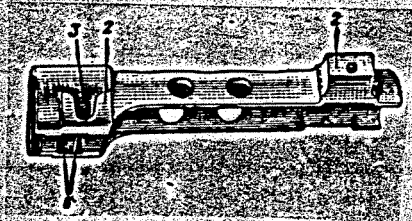


Fig. 104. Lower bracket-seat;

1- vertical lugs; 2- lugs; 3- recess

229. The collar (Fig.105) consists of two hinge-connected parts: the lower- the collar, and the upper- a hasp with an opening for passage of the front lug of the bracket-seat. The hinge pin which connects the collar with the hasp when fastening the bracket-

seat to the machine gun is placed together with the hinge to the right of the machine gun, and the bolt and locking nut to its left.

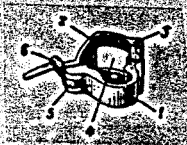


Fig. 105. Collar:

1- lower part of collar;

2- hasp; 3- hinge pin;

4- opening; 5- bolt; 6- locking nut

## CARRIAGE, ROD, AND DRIVE

230. The carriage is used for moving the front ring sight along the range ruler and for setting it on the required graduation of the range scale. The carriage has an opening for the range ruler. On top, the ring sight holder is secured to the carriage by screws. A liner is installed in the opening of the carriage under the ring sight holder, and the plate spring is placed on top of the liner. The degree of pressure of the liner on the range ruler is adjusted by the clamping screw of the plate spring. With correct pressure of the liner on the range ruler, the carriage moves freely. There is a lug with a longitudinal opening threaded for the thread of the motion screw in the lower part of the carriage.

231. The rod is a support for the back end of the range ruler and serves to connect the antiaircraft sight with the pawls of the pin of the tipping part of the mount. The rod is placed by its long arm in the cross opening of the upper bracket. The head of the rod, which is secured by a cylindrical pin, is placed on the end of the long arm of the rod.

The back bearing of the motion screw, the rim and casing of the bearing, forming a box for the lower pair of bevel gears (large and small) are attached to the head of the rod. The rod is held on the pawl of the pin of the tipping part of the mount by a hook.

The pin of the pawl is moved in relation to the pin of the tipping part of the mount. With a change in the angle of elevation the slant of the range ruler changes in relation to the axis of the bore, i. e., a correction is automatically introduced into the angle of sight depending on the angle of elevation.

232. The drive serves for advancing the carriage with the front ring sight along the range ruler when setting the range. The drive consists of the following basic parts: a motion screw designed for shifting the carriage along the range ruler which turns in the back and front bearings; a lower pair of bevel gears (large and small); an upper pair of bevel gears (both gears are the same); a rotating bearing; a shaft with a seat; a mounting ring, a shaft with ball, and a lever with handle.

## HANDLING THE ANTIAIRCRAFT SIGHT, MODEL 1938

### MOUNTING AND REMOVING THE ANTIAIRCRAFT SIGHT FROM THE MACHINE GUN

233. Mounting the antiaircraft sight on the machine gun is performed in the following sequence:

- remove the antiaircraft sight from the case; place the lower end of the rod and the pawl of the pin of the tipping part of the mount and secure it with the hook;
- place the back lug of the upper bracket in the opening of the back lug of the bracket-seat and seat the sight downward; in so doing, see to it that the cylindrical lug of the upper bracket goes into the recess of the front lug of

the bracket-seat; fasten the sight with the wing nut and screw;

- remove the front ring sight from the case, set it in the holder and fasten with a screwdriver.

234. Remove the antiaircraft sight from the machine gun when changing from position for firing on aerial targets to the position for firing on ground targets ( or in travelling position)

Removal of the antiaircraft sight is performed in the following sequence:

- set the front ring sight perpendicular to the range ruler and introduce the arm of the weight-bob into the weight holder;
- take off the fastener of the front ring sight holder, remove the ring sight and place it in the upper part of the case;
- unscrew the wing nut and screw without completely removing them from the upper bracket;
- swing back the hook and remove the antiaircraft sight from the machine gun, moving the upper bracket upward and separating it from the lower bracket-seat;
- remove the rod from the pawl of the pin of the tipping part of the mount;
- set the antiaircraft sight in the lower part of the case.

235. The rear sight and the lower bracket-seat with collar are left on the machine gun in the travelling position and also in the position for firing on ground targets. Remove them only during cleaning and disassembly of the machine gun.

Removal of the rear sight and lower bracket-seat with collar is performed in the following sequence:

- unscrew the wing nut and remove the rear sight, moving it forward; set the back and tighten the wing nut;
- place the rear sight in the case;
- unscrew the locking nut of the collar bolt; remove the removable bolt from the left; swing back the hasp and remove the collar from the machine gun;
- place the collar in assembled form in the case;
- separate the lower bracket-seat from the machine gun;
- place the lower bracket-seat in the case.

## ADJUSTMENT OF THE ANTI-AIRCRAFT SIGHT

237. The essential point in the adjustment of the anti-aircraft sight is that the line of sighting passing through the peep hole of the rear sight and the center of the front ring sight (set on the range ruler at 8 and 20) must be parallel to the line of sighting of the ground sight set at the same range, i.e., 8 and 20 with adjusting sights 8 and 20.

Adjustment of the sight at range 8 is performed with the aid of the rear sight, and at range 20, - with the aid of the range ruler.

Adjustment is performed on a clearly visible point not less than 1000-1500 m distant.

After the anti-aircraft sight is adjusted in the vertical plane, tighten the locking nut.

238. The position of the range ruler relative to the axis of the bore of the machine gun is considered correct when:

- the range ruler is slanted and composes an angle with the axis of the bore equal to  $4^{\circ} 04'$ . Obtaining and checking the angle is performed by adjusting the anti-aircraft sight.

It must be kept in mind when adjusting the anti-aircraft sight on a ground target that the sight frame is slanted to the left for automatic allowance for drift in firing on a ground target.

In order to introduce a correction for the slant of the sighting frame when adjusting the anti-aircraft, the backsight is moved to the right a specific number of graduations of the collar.

Adjustment of the anti-aircraft sight on a ground target is performed with sight setting 8 and 20 on the machine gun which is zeroed in.

The adjustment setting of the backsight when aligning the backsight of the ground sight with the sight mark 8 is called "adjusting backsight 8", and with sight mark 20 - "adjusting backsight 20".

239. Determination of adjusting backsights 8 and 20 is determined thus:

- set a thin straight rod up to 3 m high in a vertical position at a distance of 100 m from the machine gun (the machine gun is set on the mount



in position for ground or air firing);

- direct the machine gun at the rod so that the trunnions of the machine gun are placed horizontally;
- align the backsight of the ground sight with the graduation 2, backsight 0
- using the backsight slot and the front sight, with these settings, aim the machine gun at the upper part of the rod and secure the mechanisms;
- shift the backsight of the ground sight to sight 8; in so doing, the line of sighting is shifted to the right from the vertical plane of the rod (the sighting frame has a slant to the left);
- without changing the position of the machine gun, shift the backsight to the right and mark with the backsight in regard to the rod; record the setting of the backsight thus obtained (adjusting backsight 8);
- move the collar of the ground sight to mark 20; in so doing, the line of sighting is again shifted to the right of the vertical plane of the rod;
- the backsight setting thus obtained is noted by the backsight in regard to the rod (adjusting backsight 20) and recorded;
- check to see that the aim has not been knocked off.

In order to do this, shift the collar of the ground sight to sight 2 and, setting the backsight on 0, check the position of the line of sighting in regard to the initial aiming. If the line of sighting coincides with the rod, then the adjusting backsights 8 and 20 are determined correctly. If the indicated alignment does not occur, once again carefully and accurately determine adjusting backsights 8 and 20. Adjusting backsights 8 and 20 can also be determined in regard to exceptionally visible straight tree trunks, corners of buildings, telegraph poles, and so forth.

240. Adjustment of the antiaircraft sight in the horizontal plane is performed by moving the jack nut with the adjusting screw in a lateral direction relative to the upper bracket.

The antiaircraft sight is considered to be adjusted when the aiming lines of the antiaircraft and ground sights at sights 8 and 20 coincide.

In fulfilling the actions indicated in item 238, check to see whether the sight is adjusted correctly. If it appears that the sight is not adjusted sufficiently accurately, - repeat the adjustment.

## MAINTENANCE AND CARE OF THE ANTI-AIRCRAFT SIGHT

241. Protect the anti-aircraft sight from shocks. Periodically inspect screws, nuts, and individual joints and tighten them if they are loose. Lubricate all parts of the sight periodically.

In the event of fouling, wipe the anti-aircraft sight with a soft cloth. Perform a complete disassembly of the anti-aircraft sight (except for welded connections) no less than once a year under the direction of the guns.

### CHAPTER XII

#### ANTI-AIRCRAFT SIGHT, MODEL 1941

##### PURPOSE AND SPECIFICATIONS OF THE ANTI-AIRCRAFT SIGHT, MODEL 1941

242. The model 1941 anti-aircraft sight differs from the model 1938 anti-aircraft sight in the following features:

- a) The largest graduation of the range ruler equals 1800 m (instead of 2400 m in the model 1938).
- b) The values of the front sight rings are as follows:

Designation of anti-aircraft sight	Value of front sight rings			
	First	Second	Third	Fourth
	Speed, km/h			
Anti-aircraft sight model 1938 .....	100	200	300	400
Anti-aircraft sight model 1941 .....	125	250	375	500

- c) Guides have been eliminated and a constant slant of the range ruler (an angle of slant of  $2^{\circ}9'$ ) has been introduced for constructing angles of sighting depending on range.



d) Eccentricity has been introduced - a device which changes the position of the front sight in relation to its pivot axis. Eccentricity ensures a change in value of angles of sighting depending on the angles of elevation.

e) The mechanisms used for adjusting the antiaircraft sight, and also the fastenings have been simplified in design and lightened.

#### CONSTRUCTION OF THE ANTIAIRCRAFT SIGHT, MODEL 1941

243. The model 1941 antiaircraft sight (Fig. 106) consists of the removable part of the sight, the front sight, and the rear sight.

244. The removable part of the sight (Fig. 107) is used for resetting the front sight in accordance with the firing range and for adjusting.

The removable part of the sight consists of the range ruler, carriage, and post.

a) The range ruler with central axis and opening for the support screw has a pivot in the vertical plane around the central axis. The opening through which the support screw of the rocker arm passes serves for resetting the ruler from the working position to the adjusting and back.

The letters "E" (adjusting position) and "P" (working position) are set on the front face of the ruler. Graduations corresponding to firing ranges from 500 to 1800 m are placed on the lateral surface of the ruler. On the upper surface of the ruler, a toothed rack is cut for shifting the carriage along the ruler. There is a screw in the back part of the ruler to limit movement of the carriage. This screw must be unscrewed when removing the carriage.

b) The carriage moves along the range ruler carrying the front sight on it. Movement is accomplished by turning the handwheel with gears. The carriage has an adjusting screw underneath. It regulates the pressure of the slider against the range ruler. For smooth and precise operation with the sight, such pressure of the slider against the range ruler is necessary that turning of the handwheel meets with a certain resistance. There is a recess in the back part of the carriage on top for fastening the front sight which is secured either with a pin tightening a threaded bushing, or (in the new models) with a screw which enters a depression on the pin of the front sight yolk.

An indicator with the symbol "00" inscribed on it is made on the front face of the carriage.

The carriage must be mounted so that the zeros stand behind the figures inscribed on the ruler, and together with it form a three-digit number.

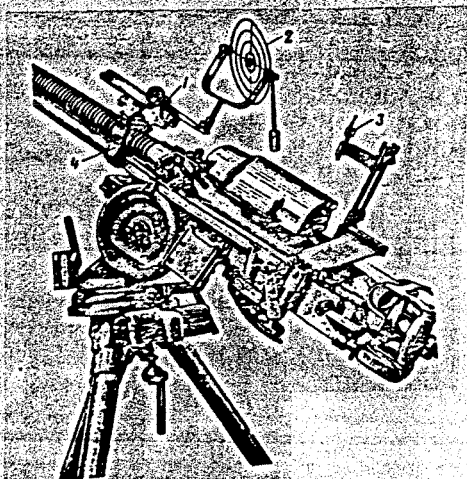


Fig. 106. General view of model 1941 antiaircraft sight on a machine gun:  
1- removable part of sight; 2- front sight; 3- rear sight; 4- collar with pin

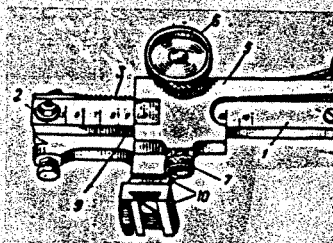


Fig. 107. Removable part of sight:

- 1- range ruler; 2- support screw; 3- toothed rack;
- 4- limiting screw; 5- carriage;
- 6- handwheel with gears;
- 7- adjusting screw; 8- holder;
- 9- indicator; 10- post with base

c) The posts with base and rocker arm provide for fastening and pivoting of the range ruler, and also for adjustment in the horizontal and vertical plane.

Horizontal adjustment is achieved by turning the whole removable part of the sight relative to the base of the post. Horizontal adjustment is performed by rotation of the eccentric.

The post is secured by a nut and a lock nut.

Vertical adjustment is performed with the nuts raising or lowering the

support screw of the rocker arm which passes through the opening in the ruler (or link - in the first models of the sight).

245. The front sight (Fig.108) consists of four concentric rings: (first, second, third, and fourth), a central hub, yoke with pin, a limiter, and a weight bob with spring. The values of the rings correspond to target speeds of 125, 250, 375. and 500 km/h.

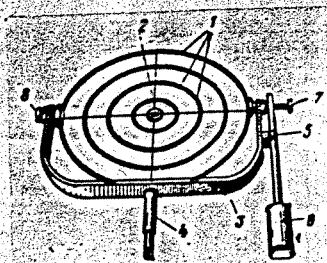


Fig. 108. Front sight:

- 1- concentric rings; 2- central hub;
- 3- yoke; 4- pin; 5- limiter;
- 6- weight-bob; 7- weight-bob spring;
- 8- screw-pin

low-flying aircraft (at an angle of elevation less than  $15^{\circ}$ ) the rings are held at the angle and do not slip.

When adjusting the screw-pin, it is necessary to make sure that the front sight turns without sticking and does not have excess pivot.

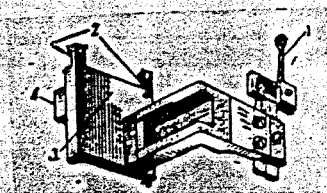


Fig. 109. Rear sight: 1- peep hole;  
2- cut-outs; 3- bracket; 4- clamp plate

The central hub is used for adjusting the antiaircraft sight and also for firing on diving aircraft.

The weight-bob directly and automatically holds the front sight in a horizontal plane and fastens the front sight in the plane of the yoke when adjusting the machine gun and during firing on diving aircraft.

The limiter is used so that with a horizontal position of the front sight and while firing on

246. The rear sight with peep hole (Fig.109) is fastened on the aiming plate of the ground sight of the machine gun so that the cut-outs in the upper part of the bracket grip the upper cross plate of the ground sight, and is held from the other side by the clamp plate.

The peep hole is moved along the horizontal in the cross opening of the peep-hole post, and in the vertical together with the whole peep-hole post.

With a lowered ground sight aiming plate, the rear sight must be folded.

The sighting frame of the ground sight of the model 1938 machine gun has a slant to the left (at an angle of  $2^{\circ}33'$ ) to allow for drift; therefore, the peep hole of the antiaircraft sight is located in relation to the bracket at the same angle, but with the slant in the reverse direction. This ensures its shifting strictly in the vertical plane.

247. The collar (Fig.110) serves for fastening the whole removable part of the sight on the barrel of the machine gun. It is installed so that the

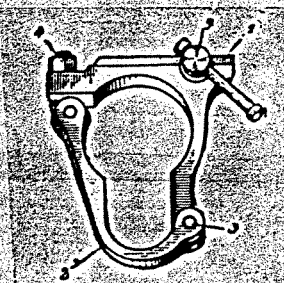


Fig. 110. Collar:

- 1- upper part; 2- lower part(hasp);
- 3- pin; 4- removable bolt with nut;
- 5- pin clamp

"dovetail" is to the left (if seen from the gunner's side). The collar has an upper part, lower part (hasp), pin, removable bolt with nut, and a pin clamp.

The place for mounting the collar on the barrel is determined by the sight line with the front sight mounted vertically and the eccentric back. When the carriage is set on mark 18, this distance should equal 275 mm.

In the case for the antiaircraft sight there are the wrench with screwdriver (or a single combined wrench-screwdriver) and instructions for using the sight.

#### ADJUSTMENT OF THE ANTI-AIRCRAFT SIGHT, MODEL 1941

248. Adjustment of the model 1941 antiaircraft sight is divided into two stages.

- a) First stage. Give the ruler a direction parallel to the axis of the bore. To do this, set the range ruler in the adjusting position, i.e., unscrew the supporting screw and lower the ruler until the mark "F" on the face of the ruler

coincides with the indicator on the bracket. The ground sight and backsight of the machine gun are set at 0. Then the machine gun is aimed at a point 1000 - 1500 m away and secured. After this, the indicator of the carriage is set on ruler mark 5 and, by adjusting the rear sight vertically and horizontally, the zero line of the antiaircraft sight succeeds in being directed at the aiming point. Then the indicator of the carriage is set on the ruler mark 18 and, by adjusting the ruler vertically and horizontally (without changing the position of the rear sight) the position of the zero line of the antiaircraft sight succeeds in this position in being directed at the aiming point.

After this, check and make sure that at any position of the carriage the zero sighting line stays directed at the aiming point.

b) Second stage. The range ruler is set in the operating position, i.e., the nut of the supporting screw is unscrewed and the front end of the ruler raised until the mark "P" on the face of the ruler coincides with the indicator on the bracket.

The indicator of the carriage is set opposite the center of the pivot axis of the ruler marked by the arrow between marks 12 and 13.

After this the peep hole is lowered.

It is necessary to make sure that in this position the zero line of sighting (with the front sight set vertical) passes through the aiming point.

With this, the adjustment of the sight is concluded.

#### OPERATION OF THE ANTI-AIRCRAFT SIGHT, MODELS 1941 and 1938

249. When transporting and transferring machine guns, and also during storage, the removable part of the sight (on the "dovetail") is separated from the machine gun and placed in the case.

Before firing, the weight bob is taken from the holder. The rings are set horizontal.

During firing, the target is aligned with the ring which corresponds to the speed of the aircraft, or with the imaginary circumference passing in the space between the rings. For example, if the aircraft speed is 430 km/h, the target is aligned with the space between the second and first rings. In this case, it is mandatory to see to it that the evident direction of movement of

the aircraft passes through the center of the front sight hub.

When an aircraft dives in the direction away from the machine gun, the front sight is set perpendicular. Firing is conducted with allowance for the aspect ratios with accompanying fire and curtain fire. For example, if the fuselage is seen as shortened in half, then the speed of the aircraft is considered to be halved, in connection with which, the corresponding ring is selected.

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## PART III

### METHODS AND RULES FOR FIRING THE 12.7-mm MACHINE GUN

#### CHAPTER XIII

#### METHODS OF MACHINE GUN FIRE

##### GENERAL REGULATIONS

250. Firing the 12.7-mm machine gun involves fulfilment of the following procedures:

- preparation for firing (setting up the machine gun in firing position, deployment of the machine gun crew behind the machine gun, loading the machine gun, mounting the sight, and aiming the machine gun);
- conducting fire (conducting the firing itself, changing sight settings and aiming points in the process of firing);
- ceasing fire (temporary or complete cease fire, unloading the machine gun, and preparation to move the machine gun forward).

251. Firing procedures are fulfilled rapidly, without anyone being distracted from observing the target and the battlefield. The gunner interrupts his observation only while installing the sight.

##### ADVANCING AND MOVING THE MACHINE GUN INTO FIRING POSITION

252. Machine guns, the cartridges for them, accessories, and spare parts are transported on the march and into combat on motor vehicles, and in winter, on ski mounts.

253. After the machine is taken from the motor vehicle, it is moved on its wheels or by hand in disassembled form.

254. Advancing the machine gun on wheels is carried out with observance of all screening measures. In order to advance the machine gun on wheels (Fig.111), the following command is given (approximately): "Machine gun advance to the destroyed building, - Forward".

At this command:

a) Number one, - the gunner:

- lowers the back part of the body of the machine gun;
- secures the traversing and elevating mechanisms;
- grasps the handhold with the right hand, and together with number two turns the machine with the drawbar (legs) forward.

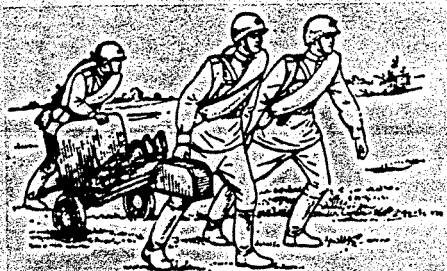


Fig. 111. Advancing machine gun on wheels

b) Number two, - aimer:

- picks up the box with cartridges in his right hand;
- grasps the handhold with the left hand and, together with the gunner, turns the machine gun around.

At the command "Forward" the gunner and number two begin to move.

c) Number three, - the leader or section commander - assists in moving the machine gun forward

by pushing it from behind against the shield.

The aimer carries the bag with the accessories.

If the gunner moves out forward in order to select a firing position, then number two and number three advance the machine gun on wheels.

255. Transfer of the machine gun in the hands in disassembled form (Fig.11) in the event it is not possible to advance the machine gun on the wheels (on severely broken terrain, in populated points, in mountains) is performed at the command (approximately): "Advance the machine gun to the bush behind the gully, remove the machine gun body, follow me, - Forward".

At this command, the gunner with number two:

- removes the shield and gives it to number three;
- removes the body of the machine gun and lifts it in their hands (the gunner by the back-plate grips and number two, by the muzzle end).

The mount is advanced on its wheels by number three with the help of the section commander (see Fig. 112).

The gunner and aimer assemble the machine gun under shelter close to the firing position.

The machine gun is moved forward in assembled form with observance of all measures for concealment applicable to the terrain.



Fig. 112. Transporting the machine gun in disassembled form

256. The machine gun is set up for firing on the universal mount which makes it possible to conduct fire on ground targets (when the mount is set on the wheels), and on aerial targets (when the mount is set on the legs).

257. Selection and preparation of the firing position is performed as expeditiously as possible.

The machine gun is moved forward into the firing position concealed from enemy observation.

258. A level area is selected for setting up the machine gun in the firing

position with the kind of soil which will ensure the stability of the machine gun when firing on ground targets and exclude the possibility of its settling. A turf-covered soil is best.

In the absence of a naturally level area, one is prepared with the aid of entrenching tools.

In the event of loose or stony soil, the wheels and spade of the machine gun are set on a base made from improvised materials.

The area is camouflaged simultaneously with its installation by using issued equipment or improvised material.

259. After installing and camouflaging the area, the gunner with the aimer move the machine gun from concealment into the firing position at a sign from the section commander.

260. When the machine gun has been moved into the firing position, the crew gets ready for combat.

a) In order to do this, the gunner:

- checks (with his eye) the setting up of the machine gun on the area and eliminates lateral slant;

- releases the traversing mechanism lock, and by moving the machine gun in the horizontal plane, determines whether there is a lateral slant to the trunnions of the machine gun;

- digs the spade of the mount into the ground;

- checks the possibility of firing on the zones assigned to him, for which he aims the machine gun at various points to the right and left within the limits of this zone.

b) Number two:

- checks the presence of everything necessary for conducting fire at the machine gun position (cartridges, lubricating materials, accessories);

- puts the ammunition box on the mount bracket;

- opens the cover of the box and prepares the belt for loading.

#### DEPLOYMENT OF THE CREW BEHIND THE MACHINE GUN

261. The basic position for firing the machine gun on ground targets is



the prone position (Fig. 113). When firing from emplacements, the standing, sitting, and kneeling positions are also employed. Standing and kneeling positions are the main one used for firing on aerial targets.

262. When firing prone:

a) The gunner:

- lies behind the machine in the direction of fire without stretching his body, as comfortable as possible for operating the machine gun;
- freely extends the legs, spreading them and turning the soles of the feet with the toes outward;
- rests his elbows on the arm rest so that they do not slip and do not hang, while the hands are reach the grips of the back plate.

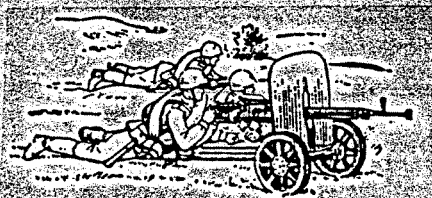


Fig. 113. Crew deployment with machine gun

b) Number two:

- lies on the left side of the gunner and slightly in front as convenient for feeding (inserting) the belt into the receiver, for operating the mount mechanisms, for receiving signs and signals from the section commander, for giving signals (by hand, by voice), and rendering assistance to the gunner in servicing the machine gun.

When firing standing, sitting, or kneeling, the position of the gunner and number is optional, - as best suited for operating the machine gun.

The other crew members of the machine gun section are deployed during occupation of the firing position according to the orders of the section commander.

## LOADING THE MACHINE GUN

263. The machine gun is loaded at the command "Load". The command "Singl round - Load" may be given in a training situation.

## LOADING THE MACHINE GUN, MODEL 1938/46

264. At the command "Load":

a) Number two:

- thrusts the tip of the belt into the cross opening of the receiver;
- advances the belt in the receiver so that the first cartridge in the belt goes into the feed pawls of the belt feed slide (Fig.114).

b) The gunner:

- sets the safety in the "Fire" position;
- with his right hand on the charging handle, forcefully with an energic motion retracts the movable system as far as it will go (Fig.115);
- returns the handle to the forward position.

Note. The movable system may also be retracted by inserting a cartridge case or a cartridge in the bolt support lever (Fig.116).

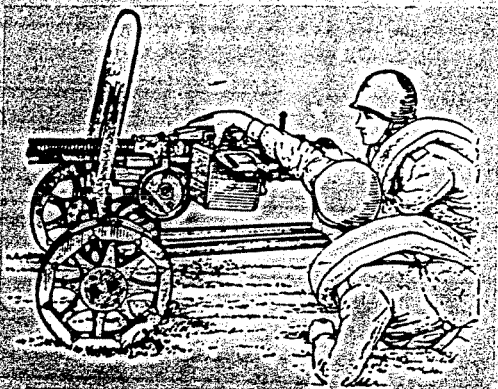


Fig. 114. Inserting the belt in the cross opening of the receiver

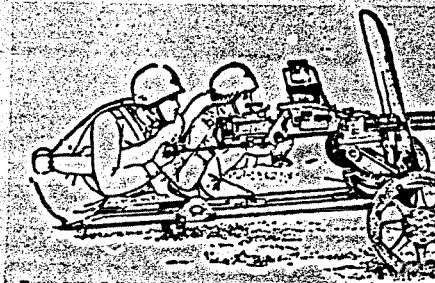


Fig. 115. Retracting the movable system with the charging handle



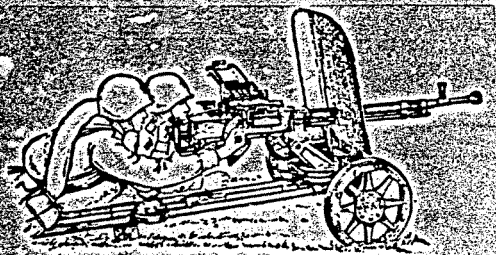


Fig. 116. Retracting the movable system by means of a cartridge inserted in the recess of the bolt support handle

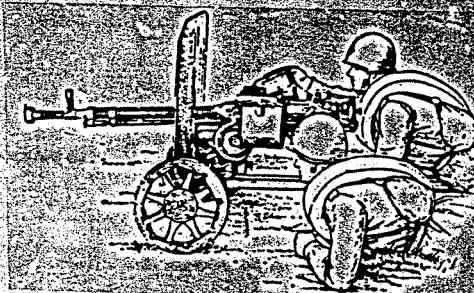


Fig. 117. Opening the receiver cover

#### LOADING THE MACHINE GUN, MODEL 1938

265. Before loading the machine gun, the bolt support must be in the extreme forward position; the box with the cartridge belt must be fastened to the mount bracket on the left side of the machine gun; and the safety set in the "Fire" position.

At the command "Load":

a) The gunner, moving forward, presses on the catch of the receiver cover and opens the cover (Fig. 117).

b) Number two:

- swings back the small cover of the ammunition box and puts the cartridge belt (Fig. 118) with cartridges on the drum of the receiver so that the first cartridge lies in the upper recess of the drum.

- pressing the belt against the drum with his left hand, with his right hand behind the free end of the belt, turns the drum together with the cartridges with a sharp motion to the right as far as it will go;

- closes the cover of the receiver on the catch.

c) The gunner, grasping the charging handle, retracts the bolt support with a sharp motion and returns the handle to the forward position.

## AIMING THE MACHINE GUN AT THE TARGET

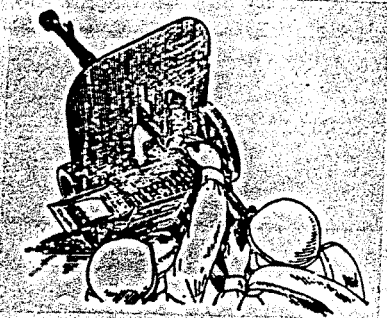


Fig. 118. Putting the belt on the drum

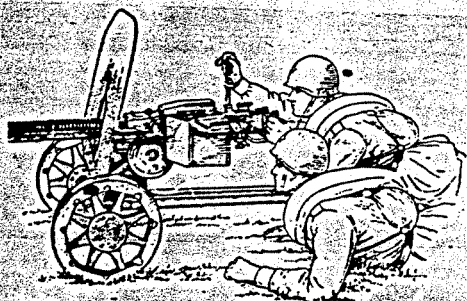


Fig. 119. Setting the sight

266. In order to aim the machine gun at the target:

a) The gunner:

- raises the sight frame with his right hand;
- grasps the backsight with his hand, presses on its catch, sets the commanded sight graduation on the upper face of the backsight, aligning it with the corresponding mark of the sight scale;
- refines the sight setting, turning the handwheel of the motion screw of the sight frame by hand (Fig. 119).

Note. The commanded backsight graduation, if it is on the rear sight, is set on the 1938 model machine gun by turning the backsight motion screw.

b) Number two: releases the rough and fine elevation mechanisms, and at the command of the gunner, secures the rough elevation mechanism.

c) The gunner:

- releases the traversing mechanism;
- grasping the handle with both hands, directs the machine gun approximately at the target;
- orders number two to secure the rough elevation mechanism;
- after this, refines the traverse with light taps of the hand on the grip of the back plate;
- using the handwheel of the fine elevating mechanism, refines the elevation;
- orders number two to report the machine gun ready.

Number two reports by raising his hand or by saying: "Ready".

## PREPARING TO FIRE ON AERIAL TARGETS

267. At the command "Action", the gunner removes the cover from the breech part. He releases the stop of the back leg of the mount and releases the lock of the front legs of the mount. He presses with his foot on the spade of the rear leg of the mount and takes hold of the grips of the back plate. He raises the body of the machine gun upward with the grips of the back plate as far as the stop and holds the machine gun until it is lowered onto the front legs of the mount. He secures the front leg stop. He raises the sight frame. He mounts the shoulder piece.

268. Number two removes the cover from the muzzle part. He lifts the left fastener of the shield. He grasps the left wheel of the carriage. With his left hand he supports the machine gun behind the carriage, and with his right hand, brings the left front leg forward and to the side as far as it will go. He lowers the machine gun onto the front legs. He places the magazine on the machine gun; sets the antiaircraft sight; releases the rough elevation clamp.

269. Number three lifts the right shield fastener; with a kick, he turns the clamp of the legs in the direction along the back leg; he removes the shield and puts it to one side. He takes hold of the right wheel of the carriage. With his right hand, he supports the machine gun behind the carriage and with his left hand, draws the right front leg forward and to the side as far as it will go.

He lowers the machine gun onto the front legs. He presses out the handle of the carriage lock and removes the carriage; he releases the traversing lock and prepares the magazine.

Note. 1. When transferring the machine gun into the position for anti-aircraft firing at the command "Aircraft" while conducting fire from the position for firing on ground targets or at the command "Action", when the machine gun is already prepared for conducting fire from the position for ground firing, the operation is carried out as indicated in items 267-269. In addition, at the beginning of operation, number one sets the body of the machine gun along the legs, shifts the safety to "Stop", takes away the seat-arm rest and lowers the

sight frame; number two secures the rough and fine elevation clamp; number three secures the traversing clamp.

2. The duties of number three are performed by the leader of section commander.

#### DEPLOYMENT OF THE CREW BEHIND THE MACHINE GUN

270. When there is a model 1938 or model 1941 antiaircraft sight on the machine gun, the gunner takes his place behind the machine gun. Number two is to the right of the machine gun by the antiaircraft sight. Number three is deployed next to the ammunition box ahead and to the left of number one.

When there is a model 1943 antiaircraft sight on the machine gun, number two is deployed ahead and to the left of the gunner (Fig.120).

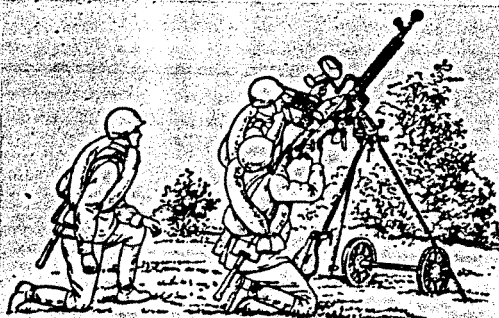


Fig. 120. Deployment of crew behind the machine gun when firing on aerial targets

position;

- sets the body of the machine gun parallel to the back leg of the mount;
- folds back the handle of the back leg stop downward;
- takes hold of the grip of the back plate with both hands, and when the other crew members are ready, tilts the machine gun forward onto the wheels.

#### TRANSFERRING THE MACHINE GUN FROM THE POSITION FOR FIRING ON AERIAL TARGETS TO THE POSITION FOR FIRING ON GROUND TARGETS

271. When a mission is received to fire on ground targets, the machine gun is transferred to the position for firing on ground targets upon the command of the section commander, "Machine gun on the wheels" in two procedures.

##### First procedure.

##### a) The gunner:

- shifts the safety to the "Stop"

b) Number two:

- unfastens the rough and fine elevation mechanisms;
- removes the shoulder piece from the mount.

c) Number three:

- unfastens the traversing mechanism;
- removes the antiaircraft sight and puts it in the case;
- connects the carriage with wheels to the mount and fastens it;
- tilts the machine gun forward and sets it on the wheels.

Second procedure.

a) The gunner:

- compresses the legs after contraction;
- sets the seat-arm rest to one side;
- lies down behind the machine gun.

b) Number two:

- releases the rough elevation clamp;
- turns the clamp of the front legs and presses the legs;
- takes his place to the left of the gunner.

c) Number three:

- releases the traversing clamp;
- takes his place to the right of the gunner;
- puts on the shield and fastens it;
- prepares the ammunition for firing.

Translator's note:

Foreign pages 222-223 are missing from text.

276. The following actions are taken in order to denote the limits in depth of traversing fire.

On the sight.

The gunner:

- Aims the machine gun along the line in accordance with the setting of the sight;
- without changing the position of the machine gun, moves the back-sight slide the commanded number of graduations higher or lower and makes note of a point on the terrain where the sighting line is directed;
- sets the back-sight slide in the original position;
- smoothly turns the handwheel of the fine aiming mechanism;
- transfers the sighting line several times from the line to the point noted on the terrain and back again;
- makes note of the limits of rotation of the handwheel by hand in order to obtain the required traverse in depth.

On the sight ring(when there is one)

a) The gunner:

- aims the machine gun at the line;
- sets the sight ring;
- smoothly rotates the handwheel of the fine aiming mechanism in the appropriate direction.

b) Number two makes note on the ring of the limits of rotation of the handwheel in order to obtain the required traverse in depth.

277. In order to aim the machine gun according to the mark made earlier:

a) The gunner sets the sight ( backsight and sighting ring) according to the data obtained when marking the machine gun and from these settings aims the machine gun at the corresponding aiming point.

b) Number two carries out the same operations as in aiming the machine gun.

PRODUCING FILE

PIPING



## CONDUCTING FIRE

### FIRING

278. In combat, the gunner conducts fire in accordance with the commands of the section (platoon) commander or independently.

The command for opening and conducting fire indicates a target (reference point), the sight (backsight and sighting ring if it does not correspond to the sight setting), an aiming point, type of fire, and number of rounds necessary to destroy the target.

279. The command "Fire" is given after the report or sign from number two regarding readiness of the machine for opening fire.

280. Firing in bursts is conducted with interruptions. The length of the interruptions between bursts is determined by the time required for checking the aim and for observing the results of fire.

281. During tense moments of combat, machine gun fire is conducted continuously until the commanded number of rounds have been expended or until the command "Stop".

Firing in bursts commences at the command "In bursts (or two or three burst - Fire".

Example. "Machine gun five, by the bush, aim below the target, three bursts Fire".

Translator's note:

Foreign pages 226-227 are missing from text.

is b) The gunner aims the machine gun at the new aiming point and, if there is a movable backsight, first sets the backsight and aims the machine gun at the previous aiming point.

b) Number two, on orders from the gunner, reports to the section commander that the command has been executed, giving the new setting, for example: "Left, six, - Ready".

287. In order to change elevation, the command is given: "The aim is such" or "Aim there". At this command:

a) The gunner sets the sight on the commanded graduation and aims the machine gun at the aiming point.

b) Number two:

- releases the mechanisms, and secures them when the gunner has finished aiming the machine gun;
- reports the new sight setting to the commander;
- reports readiness to open fire.

289. When registering fire by bracketing a target, at the command "Register Fire":

a) The gunner, fastening the aiming mechanism, fires a round. At the next command, he changes the setting of the sighting devices, fastens the aiming mechanisms, and again fires a round. Firing in bursts is conducted until the setting of the sighting devices is found which is necessary for certain destruction of the target.

b) Number two releases and fastens the aiming mechanisms at the command of the gunner.

290. When registering fire by approaching the target in bounds, at the command "Register in bounds forward (backward) - Fire":

a) The gunner:

- conducts fire in bursts with the aiming mechanisms secured;
- creates an interval after each burst in order to make a correction on the back-sight or on the ring.

b) Number two changes (increases or decreases) the angle of elevation of the machine gun on the sighting ring by one graduation after each burst, and in the absence of a ring, releases and fastens the aiming mechanisms and reports readiness to the gunner.

At the command "Stop", number two reports the sighting ring setting to the section commander.

#### CEASING FIRE

291. The cease fire can be temporary or complete. For a temporary cease fire, the command "Stop" is given, and for complete, - "Unload".

292. For a temporary cease fire, the gunner lets go of the triggers.

293. In the event of a complete cease fire:

- a) The gunner lets go of the trigger and unloads the machine gun, for which:
- he sets the movable system on the safety, sets the sight on the zero mark, and lowers the sight frame;
  - he opens the cover of the receiver;
  - after this, as number two removes the belt, he removes the remaining cartridges from the cartridge chamber and the receiver;
  - making sure that there are no cartridges in the cartridge chamber and receiver, he lowers the receiver cover into place;
  - he sets the safety in the "Fire" position and releases the movable system from the sear notch.
- b) Number two withdraws the belt from the receiver and puts it in the box.

## CHAPTER XIV

### REGULATIONS FOR FIRING 12.7-mm MACHINE GUNS

#### GENERAL INFORMATION

294. Machine gun fire is characterized by the following data:

Range of direct fire on ground targets (B-32 bullets):

- at an embrasure (55 cm in height) with sight 4 - up to 400 m;
- at a machine gun (55 cm in height) with sight 5 - up to 500 m;
- at a gun (110 cm in height) with sight 6 - up to 600 m;
- at an armored personnel carrier (180 cm in height) with sight 8 - up to 800 m.

Number of rounds for destruction of ground targets:

Firing range \ Target dimensions and number of rounds	Machine gun (Target No. 10)	Antitank gun (Target No. 11)	Armored personnel carrier (Target No. 13)
Up to 600 m .....	8	2	1
Up to 800 m .....	17	3	2

Note. For the remainder, follow the data in Table 4 (Appendix 3).

When firing at aerial targets, ranges are calculated as follows:

- maximum - from 2000 to 1500 m;
- medium - from 1500 to 500 m;
- short - from 500 m and less.

Firing at maximum ranges is permitted in exceptional cases if required by the combat situation.

When firing on low-flying aircraft, it is most expedient to fire in short bursts with no less than two machine guns.

#### SELECTION OF FIRING POSITIONS

295. The section commanders select the firing positions for machine guns depending on the mission assigned and the developing situation in the area (place) indicated by the platoon commander or independently.

The firing position must ensure:

- the capability of successfully fulfilling the assigned mission;
- observation and field of fire in the necessary directions, making it possible to conduct precision fire on ground and aerial targets;
- concealment from both ground and air enemy;
- maximum protection against tank attack;
- reliable communication with the commander;
- concealed communication routes with means of connecting with the rear and with alternate positions.

The site for connecting facilities must ensure concealment from enemy fire and concealment from ground and aerial observation, and also good routes of communication with the main and alternate firing positions and with the rear.

Machine gun fire is conducted from the main or alternate fire positions. Firing positions are made open, semi-concealed, and concealed.

296. Machine gun positions of units or objectives which are concealed from the air are placed in a radius of their effective fire. In order to create the most suitable conditions for firing on diving aircraft, the fire positions for the machine guns are placed in direct proximity to the objective being defended or on the objective itself.

#### OBSERVATION OF THE BATTLEFIELD

297. In order to achieve timely observance of targets, machine gunners must attentively and directly observe the battlefield, and pay special attention to



the action of enemy means of fire, enemy personnel, and enemy armored targets

298. Observation is conducted with the naked eye consecutively scanning (from right to left and from near sectors to far) of the entire assigned zone of fire. Binoculars or a periscope are used for inspecting suspicious spots and for examining the terrain at distances greater than 600 m.

Each machine gunner must be able to quickly observe a target in regard to various signs, as, for example: movement, firing, bursting of shells, operational sounds, and so forth.

299. The machine gun- observer is obliged to report directly to the nearest commander regarding everything noted on the battlefield. The report must be brief and accurate. A typical form of report is: "Reference point two, two fingers to the right, close to a hundred bushes, behind a bush - a gun".

300. For timely observance of aerial targets, a site with good all-round observation must be chosen, not farther away than voice communicating distance from the commander; if observation from the ground is insufficient, use is made of local elevated objects, for example, the roofs of houses, or trees.

For direct target designation, the section commander, using a compass, breaks down reference points by cardinal points of the compass around the halting point of the section; for this:

- if an Adrianov compass is available, he brings the 30-00 mark under the north end of the needle, sets the indicator by the notch consecutively on the marks 0-00, 15-00, 30-00, and 45-00; by sighting through the notch and front sight, he gives the direction corresponding to the 1st, 3rd, 5th, and 7th reference points;

- if a compass with graduations in degrees is available, he sets the  $0^{\circ}$  mark under the north end of the needle and in the  $0^{\circ}$ ,  $270^{\circ}$ ,  $180^{\circ}$ , and  $90^{\circ}$  mark directions indicates direction corresponding to the 1st, 3rd, 5th, and 7th reference points. Directions to the intermediate 2nd, 4th, 6th, and 8th reference points are determined with the eye.

One of the section crew members measures off distances up to 5 m in the directions indicated by the section commander and sets out the reference points



correspondingly as follows:

- 1 (North);
- 2 (Northwest);
- 3 (West);
- 4 (Southwest);
- 5 (South);
- 6 (Southeast);
- 7 (East);
- 8 (Northeast).

Reference points are also broken down around the deployment site of the platoon commander.

301. An aircraft is detected by the sound of its engine and by observation. The sound of an engine is heard 10-12 km away. An aircraft is seen with the naked eye at a distance of 7-9 km.

After hearing the noise of the engine, determine the direction of flight of the aircraft, and then look in that direction until it appears.

Example. Two enemy aircraft have appeared over the fifth reference point.

Having observed the aircraft, the observer loudly reports to the commander: "Air, fifth, two (such and such aircraft)".

If the aircraft cannot be recognized, the observer reports: "Air, fifth, two unidentified".

Each change of course by the aircraft is reported to the commander.

Example. "Target has changed course to the second (the number of the reference point).

Aircraft origins and types are determined from their silhouettes (from their outlines).

302. Target indication according to reference points (item 300; 301) may also be used for indicating moving ground targets (vehicles, tanks, armored personnel carriers, and so forth).

#### TARGET SELECTION

## TARGET SELECTION

303. The following are targets for the 12.7-mm machine guns: machine guns, individual guns, armored personnel carriers, motor vehicles, groups of the embrasures of defensive structures, aircraft, parachute landings, and aerial flare bombs.

Targets are as follows: single and grouped; wide, deep, or narrow; areas; open and camouflaged; stationary or appearing suddenly, rapidly being hidden and moving; observable and unobservable.

304. Aircraft, in respect to the firing position of the machine gun may:

- fly across the front (Fig.121);
- fly a  $0^{\circ}$  heading (approaching the OP firing position), (Fig.122);
- fly a  $180^{\circ}$  heading (away from the OP) (Fig.123);
- dive on the gun or on an objective removed from the machine gun firing position.

305. The commander indicates the target for the machine or the gunner selects it independently. When conducting fire independently, the gunner must determine the character, location, dimensions, distance, and importance of the target and must first destroy the most important and dangerous targets: enemy machine guns, and armored personnel carriers, and so forth. In the event the targets are equally important, the nearest one is selected.

## DETERMINING DISTANCE

306. Accurate determination of distance is a necessary condition for accurate firing. As the distance to the target increases, the accuracy of its determination must be increased.

In a combat situation, the range to the target is determined as follows:

a) For ground targets:

- by visual estimation;
- by firing tracer bullets;

- by measuring in paces
- from the angular values of local objects.

b) For aerial targets:

- by visual estimation;
- with the universal lyre (Fig.124);
- from reference points.

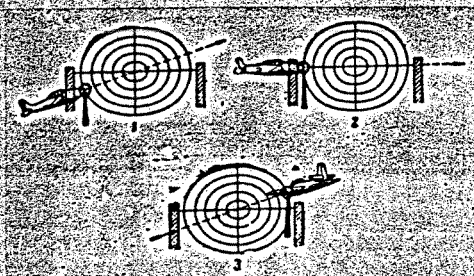


Fig. 121. Selection of aiming point on front ring sight when target is moving horizontally:

- 1- aircraft reaches the track parameter;
- 2- aircraft on the track parameter;
- 3- aircraft leaves the track parameter

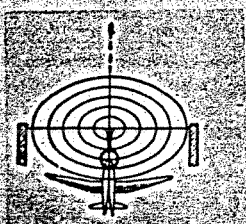


Fig. 122. Aiming at an aircraft heading on  $0^\circ$  course with 1938 and 1941 sights with sight horizontal

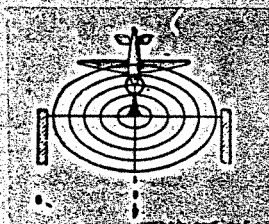


Fig. 123. Aiming at an aircraft heading on  $180^\circ$  course with 1938 and 1941 sights with sight horizontal

307. Determination of distance by visual estimation can be made from sections of terrain, from the degree of visibility of objects or targets and combining the methods indicated.

Determination of distance from sections of terrain is applicable only on level ground. With the section of terrain firmly fixed in his visual memory, the person making the visual measurement,

mentally (with the eye) lays it out the necessary number of times in the direction to the object to which the distance is being determined.

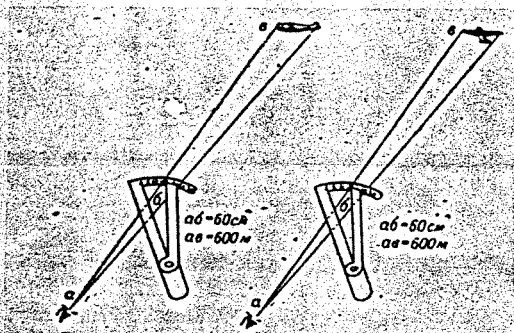


Fig. 124. Determination of range to an aircraft with a universal lyre

In so doing, he must remember the following:

- with the increase in distance, the size of the apperceptions gradually decreases;
- uneven terrain spots (ravines, hollows, accidents of the terrain) which are not visible over the entire width, and also a uniform surface (a meadow, and so forth) will conceal dis-

In order to determine distance from the degree of visibility of objects or targets, each machine gunner must have his own notebook. It must be indicated in it how various objects and targets at distances from 100 to 1000 m appear to him.

When determining distances from degree of visibility of objects, the following are taken into account:

- small objects (bushes, hillocks, individual figures) appear to be located farther away than large objects at the same distance (a tank, motor vehicle, a column of troops, woods, an elevation);
- objects in bright colors (white, red) appear to be closer than dark ones (black, blue, brown);
- on terrain of one color and uniform background (a meadow, snow, plowed land) objects which are of a different color appear to be closer;
- a multicolored varied terrain background conceals and, as it were, moves objects farther away;
- on a gloomy day, in rain, at dusk, and in fog, distances appear increased, and on a bright sunny day - reduced.
- in mountainous terrain, objects appear to be closer.

In order to simplify visual determination of distance, the distance to be determined is compared with a previously measured distance to fixed reference points.

In order to visually determine distance to a target, several machine gunners may be called upon and the average of their measurements taken.

Example. The distance determined by the first machine gunner is 600 m, by the second - 700 m, and by the third - 500 m; the average distance is 600 m.

Skill in rapid and accurate visual determination of distance is acquired only with constant practice.

308. In order to determine distance by firing, registration fire and fire with BZT (armor-piercing- incendiary- tracer) bullets are employed.

309. When measuring distance by direct measurement of terrain, the counting of paces is done in pairs. In measuring, it is necessary to know the average value of one pair of paces. This is done by accurately measuring (with a tape measure, a ruler) a distance of 200 m on a level site. This distance is walked two or three times, each time counting the pairs of steps.

Example. When the 200 m distance is crossed three times, 131, 130, and 129 pairs of steps are obtained. The average value of one pair of paces will equal

$$\frac{131+130+129}{3} = 130; \quad \frac{200}{130} = 1.54 \text{ m.}$$

Example. When measuring a section of terrain, 260 pairs of paces are obtained; consequently, the distance equals

$$260 \times 1.54 = 400 \text{ m.}$$

310. Determination of distances from angular values is possible only when the width and height of the object (target) to which distance is being determined are known. Measurement of angular values of the object (target) is made in thousands. When computing the distance, this formula is used

$$D = \frac{V \cdot 1000}{U},$$

where D- range, V- width(height) of object, U- angular value of this object (target) in graduations of the goniometer (thousands), 1000 - a constant value.



Measurement of angular values of an object (target) is made from the reticle of binoculars, from the millimetric scale of a ruler, or with the fingers (in this case, the width of the fingers in millimeters must be known beforehand). When measuring angles with a ruler or with the fingers, hold the at a distance of 50 cm from the eye. At this distance, 1 mm covers an angle equal to 2 thousandths.

Example. A tree 20 m high is covered by two large divisions of the binocular reticle (0-20). Distance to it equals

$$D = \frac{20 \cdot 1000}{20} = 1000 \text{ m.}$$

311. When determining range to an aircraft visually, be guided by the visible outlines of the aircraft. The use of this method of determining range requires considerable practice and constant training.

312. Determination of range to an aircraft with the universal lyre is made in the following manner:

- a) When observing the enemy plane, determine its type.
- b) Set the movable ruler of the lyre on the graduation of the arc scale corresponding to the dimensions of the aircraft, according to the wingspan (when the aircraft is flying toward the observer or away from him), or according to the length of the fuselage (during oblique movement).
- c) Stretch the hand with the lyre 60 cm from the eye. In so doing, hold the lyre perpendicular to the line of sighting and parallel to the wings of the aircraft if range is being measured from the wingspan, or parallel to the course if range is being measured from the fuselage.
- d) Note at what point of the gap of the lyre the aircraft is placed (according to wingspan or length of fuselage). The figure showing on the ruler at this point indicates the range to the aircraft in hundreds of meters (in its graduations).

313. Determination of range to an aircraft according to reference points is made thus:

- a) Select reference points on the terrain which are easily visible from the



firing position in good time, and determine the distances to them.

b) Number the selected reference points and plot them on the antiaircraft range card (Fig.125).

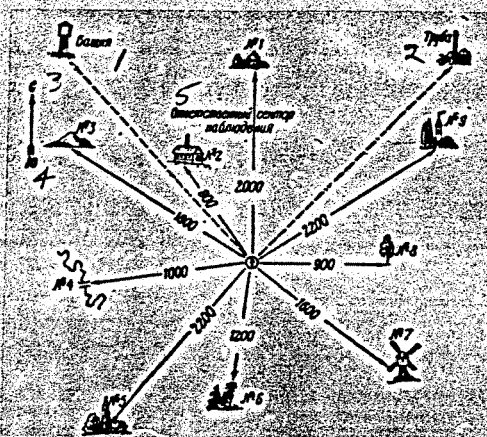


Fig. 125. Section commander's antiaircraft range card

Key: (1) tower; (2) chimney stack; (3) N; (4) S; (5) sector of observation responsibility

c) Determine the range to the aircraft at the moment the aircraft flies over the reference point. In so doing, make the assumption that the range to the aircraft is equal to the horizontal distance to the reference point. The distances to the reference points must be known by heart.

The described method of determining range is applicable only in those cases when the altitude of target does not exceed 500 m.

314. As a rule, range to the target is determined by the one who does the firing.

If the target approaches the firing position, then, depending on its speed, give the range as 100-300 m less than that which was determined.

If the target is moving away - give a range command 100-300 m greater than that obtained in determination.

The range is set on the sight continuously.

315. The number of the ring and the position of the ring sight (perpendicular or horizontal) is changed by the tracker at the command of the one firing or independently.

#### SELECTION OF THE SIGHT AND AIMING POINT

316. The sight setting and the selected aiming point are correct if the target under fire is covered by the effective cone of fire.

In order to select the sight, determine the distance to the target and let the external conditions which can have an effect on range and direction of the bullet's flight: air temperature, wind, and also, when firing in mountains and at aerial targets, - the angle of elevation of the target.

If the aiming point is not indicated by the commander when firing on ground targets, aim under the middle of the lower edge of the target. When firing with transfer of fire along a front - at one of the flanks of the target, and when firing on aircraft, - at the nose of the aircraft.

In critical moments of combat when there is no time to refine and change the sight setting, fire is conducted with a sight setting corresponding to the point blank range for the target under fire.

317. With the firing range of machine guns up to 1600 m, calibration tables for external firing conditions are used.

#### METHODS OF CONDUCTING FIRE ON GROUND AND AERIAL TARGETS

##### METHODS OF FIRING ON GROUND TARGETS

318. The methods of conducting machine gun fire on ground targets which are employed are the following: fixed pin-point fire and pin-point fire.

Fixed pin-point fire is used for firing on small targets (embrasures of defensive structures, a machine gun or gun in position) when the distance to the target has been determined accurately and external firing conditions have been learned.

Pin-point fire is used when the distance to the target has not been determined sufficiently accurately, observation of results of fire are hampered, and exterior firing conditions have not been learned precisely.

319. In respect to tactical purposes, machine gun fire is divided into annihilating fire, neutralizing fire, and interdicting fire.

Annihilating fire is conducted for the purpose of destroying enemy personnel and means of fire deployed both in the open and in shelters (in trenches, defensive structures, buildings, in armored personnel carriers, and so forth).

Neutralizing fire is conducted for the purpose of temporarily depriving the enemy personnel and means of fire of their combat power.

Interdicting fire is conducted against ground targets for the purpose of denying the enemy the capability of crossing a specific line or of advancing in a given direction.

320. Machine gun fire is divided according to intensity into continuous fire and fire in bursts.

321. Depending on the position of the target and the direction of the machine gun fire, frontal, flanking, and cross fire are employed.

Frontal fire is conducted at a right angle to the target front; such fire is less effective in comparison with the other types of fire.

Flanking fire is conducted against the flank of the target. This type of fire possesses the greatest effectiveness and density. Fire directed along columns, trenches, streets, openings, and so forth, produce this effect.

Cross fire is conducted at the same target simultaneously from no less than two directions. This is the most destructive and stunning type of fire for the enemy, especially when it is opened suddenly.

322. Fire is divided according to method of employment into concentrated, distributed, and divided.

Concentration of fire - this is the simultaneous direction of the fire of several machine guns at the same target.

Distribution of fire - this is simultaneous firing on a wide or deep target with several machine guns, between which the front of the target (or depth of the target) is completely distributed.

Division of fire - this is the directing of fire of a machine gun platoon at various separately located targets for their simultaneous destruction.

323. If the commander is not directly controlling the fire, he sets up the fire mission.

Example. "First section, reference point two - the bare tree, right 10, up 100, a gun - Neutralize".

When the fire mission has been received, the machine gunners conduct fire at the command of the section commander.

#### EXAMPLES OF FIRE COMMANDS FOR GROUND TARGETS

1. For conducting concentrated fire on a small stationary target.

"Reference point two, right one hand, yellow bush - a gun, 8, aim under bush, at the point, short bursts, platoon - Fire".

2. For distribution of fire over a wide target.

"Left behind the tanks, armored personnel carriers, at the armored personnel carriers, 7, first section at the first, second section at the third, third section at the fifth, long bursts, platoon, - Fire".

3. For conducting concentrated fire on a wide target.

"Directly at the border of the farm, motorized infantry, 10, first section aim at right edge of farm, second section - at the center, third section - at the left edge, two long bursts, platoon, - Fire".

4. For conducting concentrated fire on a wide and narrow target.

5. For division of fire.

"Reference point three, the highway column of trucks, 10, first and second sections aim at head of column, third - at tail, in a strip, long bursts, platoon, - Fire".

"First section - reference point one green bush, right 30, up 100, machine gun second section - reference point two, white rock, left 20 - a gun; third section - reference point four, down 200-observation point, 8, a strip, short bursts, - Fire".

324. The gunner is required to watch where the bullets are striking while firing, and if necessary, to change the position of the aiming point and set the sight. Bullets striking ahead of and also behind the target indicate that the sight setting has been correctly selected.

#### METHODS OF FIRING ON AERIAL TARGETS

325. Machine gun fire is conducted according to observed aerial targets as:

- tracking;
- curtain;
- barrage.

326. Barrage fire is conducted against unobserved aerial targets.

327. Depending on the nature of movement of the target and the combat situation, the one firing can change the method of fire and type of fire during the process of firing.

328. Tracking fire - is the method of firing in which the gunner, in the course of a long or short burst, or while firing continuously, keeps the target constantly on the ring (actual or imaginary) corresponding to the speed given



in the command. When operating 1938 and 1941 sights, the gunner changes the sighting point on this ring with an allowance so that the straight path of the aircraft extended from the sighting point on the ring (along the axis of the fuselage in the direction of movement of the target) passes through the center of the ring sight.

329. Tracking fire - is the main method of firing on aircraft which is used for firing at individual aircraft and groups of aircraft. It provides the capability throughout the entire course of firing to create the greatest density of bullets at the target and to perform direct aiming at the target during the entire course of the firing.

Each machine gun begins to conduct tracking fire as it becomes ready:

- at maximum ranges - in short bursts;
- at medium and short ranges - in long bursts;
- on diving planes and ground attack planes - with continuous fire.

When a platoon is firing tracking fire on a group of aircraft flying in tight formation (at a distance of about 25 m from one another) it fires at the middle aircraft in relation to the firing position.

When the distance between adjacent aircraft of a group exceeds 50-60 m, each aircraft is considered as a single aerial target.

In all cases when the situation permits, the fire of the whole platoon is concentrated on the same target.

330. Curtain fire - is the method of firing in which the gunner, in the first burst, brings the aiming point ahead on the track of movement of the target. He conducts fire by holding the barrel in a stationary position until the target passes through the sector being fired on. The amount of advance of the aiming point and the moment of commencing and ending the burst is determined from the value of the radii of the two rings selected in correspondence with the speed and aspect of the target. The direction of advance of the sighting point is determined by the gunner from the heading of the aircraft (Fig.126).

As a rule, curtain fire is employed:

- a) with great angular target speeds when continuous aiming on the moving target is hampered;



b) against aircraft diving on an objective at a distance from the firing position of the antiaircraft machine gun;

c) at barely visible targets (at twilight, in fog, with sparse cloud cover, and so forth) when continuous aiming is hampered;

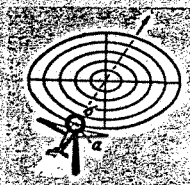


Fig. 126. Selecting an aiming point when conducting curtain fire. The aircraft reaches the course parameter. The ring sight is set horizontal.

the direction of movement of the target. After this, the gunner directs the machine gun at the edge of the cloud opposite the spot where the aircraft entered, catches the aircraft as it appears, and conducts fire in accordance with the latest commands.

332. Fire is conducted against diving aircraft without interruption at the first indication of the beginning of the dive.

333. Fire is conducted against an aircraft diving on an objective at a distance from the firing position just as against a level flying aircraft, with allowance for target aspect and increased speed while diving. In this case, the speed of the aircraft computed on the sight must be increased approximately  $1/4$  (Fig.127).

334. The gunner opens fire against an aircraft diving on the firing position of the machine guns at the moment he receives the command from the one conducting fire or independently. He aims at the nose part of the aircraft through the hub of the ring sight (Fig.128).

When conducting curtain fire, it may be considered that all the bullets will not hit the target, but only those bullets in the middle of the burst.

Curtain fire is placed in a slanted or vertical plane.

331. When firing at a target with changing visibility when the aircraft enters a cloud, the gunner fires a long burst without changing the rate of shift of the barrel in

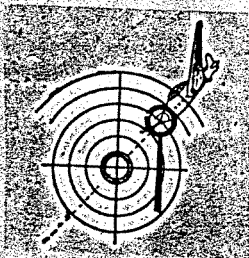


Fig. 127. Aiming at an aircraft diving on a nearby point, using 1938 and 1941 sights, with  $1/2$  aircraft aspect ratio and speed of 400-450 km/h

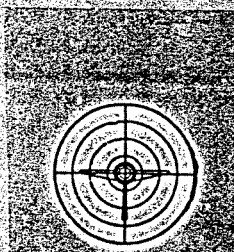


Fig. 128. Aiming at an aircraft diving on the machine gun. The ring sight is set perpendicular to the line of sight.

335. The gunner opens fire on ground attack aircraft unexpectedly appearing out of the clouds, from behind ground concealment, out of the sun, and so forth upon command or independently and fires continuously. In so doing, the gunner, without using the ring sight, changes the direction of the machine gun barrel depending on the results of personal observation of tracer bullets achieving alignment with the track of the target.

336. Fire is conducted against tight groups of parachutists, as a rule a platoon at ranges not exceeding 1000 m. Fire is conducted against individual parachutists by individual machine guns at ranges not exceeding 500 m. Fire is conducted in short bursts.

337. Barrage fire - is the method of fire with which a unit of anti-aircraft machine guns set up barrage fire on a slanted or vertical plane on the assumed course of movement of the target. It is conducted against unobserved targets (at night when the target is not illuminated by a searchlight, and by day in the event of low dense cloud cover).

338. Barrage fire is conducted at the azimuth given in the command by the platoon commander. An angle of elevation, independent of the conditions of movement of the target (at the firing position of the machine guns or on an oblique relative to it) is assigned equal to  $30^\circ$  if the altitude of the target is less than 500m, and equal to  $60^\circ$  if the altitude of the target is from 500 to 1600 m.

339. When the target moves directly at the firing position of the machine gun platoon, barrage fire with lateral traverse is set up, and when the target moves on an oblique, - with vertical traverse. In each case, five short bursts are fired. If, after the barrage fire has ended, it appears that fire was opened prematurely and that the target has not yet passed the line being fired on, then barrage fire is repeated with the same or with refined settings.

340. If the aircraft has passed the line being fired at and there are no other targets approaching the objective within the reach of the fire of the machine guns, -barrage fire is set up against that same target as it moves away from the firing position if the speed of the aircraft is less than 500 km/h.

341. Preparation for firing on an observable target begins the moment that the target is observed. It consists of:

- determining speed and angular altitude of the target, aspect ratio, and range to the target;
- setting on the sight of the ring sight (angular altitude and range, respectively);
- selecting the aiming point on the ring sight.

342. Speed of movement of the target is determined according to the type of aircraft and also on the basis of previous observations. The number of the sight ring (actual or imaginary) is given in the command in accordance with the following table.

Antiaircraft sight designation	Ring number (not counting hub)	Target speed to which sight ring corresponds (km/h)	Rings
Model 1938	1	100	Actual
	2	200	" "
	3	300	" "
	4	400	" "

Antiaircraft sight designation	Ring number (not counting hub)	Target speed to which sight ring corresponds (km/h)	Rings
Model 1938 contd.	5	500	Imaginary
	6	600	""
	7	700	""
Model 1941	1	125	Actual
	2	250	""
	3	375	""
	4	500	""
	5	625	Imaginary
	6	750	""
Model 1943	Determination of the necessary graduation is made from the table which is fastened on the face of the sight (Item 204).		

343. The angular height of the target is determined visually. If the angular elevation of the target is less than  $20^{\circ}$ , then the ring sights of the 1938 and 1941 model sights are set perpendicular to the range ruler. With angular elevations equal to  $20^{\circ}$  and more, the ring sight is set horizontal (along the weight-bob). In the latter case, the number of the ring is designated without regard for aspect ratio.

344. When it is impossible to conduct fire with the ring sight set horizontally (there is no time to reset the ring sight, the gun crew consists of less than three men), fire is conducted with the sight set perpendicular with allowance for aspect ratio and regardless of the size of the angular elevation.

345. When firing with allowance for aspect ratio (Fig. 129) (the ring



sight set perpendicular to the range ruler) the command is given for the ring number corresponding to the speed of the target reduced 4, 2, and  $\frac{4}{3}$  times corresponding respectively to aspect ratios of  $\frac{1}{4}$ ,  $\frac{2}{4}$ , and  $\frac{3}{4}$ . With an aspect ratio of  $\frac{4}{4}$ , the command is given for the ring corresponding to the measured speed of the target without change

TABLE OF TARGET ASPECT RATIOS

Course Angles							Aspect Ratios
0°							$\frac{0}{4}$
15°							$\frac{1}{4}$
30°							$\frac{2}{4}$
50°							$\frac{3}{4}$
90°							$\frac{4}{4}$

Fig. 129. Aspect ratios of an aircraft passing over a front

The number of the ring is given in the command in multiples of halves (for example, 4;  $3\frac{1}{2}$ ;  $2\frac{1}{2}$ , and so forth) always rounded off to the higher side.

346. When conducting curtain fire, two ring numbers are given in the command: for the 1941 model sight - the number of the ring corresponding to a speed 125 km/h greater and 125 km/h less than the speed which was determined for the 1938 model sight - the number of the rings corresponding to speeds 100 km/h less than the determined speed.

When firing according to aspect ratios, the ring numbers are assigned taking into account the target aspect ratio.



347. The target aspect ratio is determined visually or with the aid of an aspect ratio- range finder on the visible length of the aircraft fuselage.

With the target moving horizontally straight at the machine gun position or away from it (at course angles of  $0^\circ$  and  $180^\circ$  or close to them), the course angle in a sloped plane is equal to the angle of elevation of the target. In this case, the aspect ratio is determined from the angle of elevation of the target.

348. Range to the target is determined with the universal lyre, according to local objects (reference points), and with the lyre. The range command is given in sight graduations rounded to 100 m.

349. Preparation for night firing at illuminated targets is carried out just the same as for firing by day.

350. Fire is conducted against aircraft with armor-piercing -incendiary and armor piercing- incendiary- tracer bullets.

351. In order to open fire, the one firing indicates the target and, depending on its character of movement, assigns:

- the ring sight setting;
- the range at which to open fire;
- the ring number (two ring numbers when firing curtain fire);
- method of fire (only when firing curtain fire);
- type of fire (short or long bursts).

#### Examples of fire commands for aerial targets:

##### 1. For firing tracking fire:

"At the aircraft over such and such reference:

vertical (horizontal) (ring sight set perpendicular to the range ruler or horizontal along the weight-bob);

00 (range in hundreds of meters);

0 (ring number);

short (long) bursts;

Fire".

2. For firing curtain fire;

"At the aircraft over such and such reference point;

curtain fire;

vertical (horizontal);

00 (range in hundreds of meters);

from 0 to 0 (ring sight number at beginning and at end of burst);

Fire".

3. For firing on an aircraft diving on the machine gun position:

"At the diving aircraft. Fire".

4. For firing at ground attack planes appearing at ranges up to 500 m:

" At the ground attacker. Fire".

352. With exceptionally well trained gunners and proficiency of the machine gun crew as a whole, determination of the ring sight setting (vertical or horizontal) corresponding to the angle of elevation of the target, determination of aspect ratio and selection of the ring number corresponding to the aspect ratio are permitted to be made by the appropriate machine gun crew members. In this case, the one conducting the firing gives a command with the target speed without calculating aspect ratio instead of a command with the ring number.

353. Reference point indicators (little plates) are set up at the gun position to give the machine guns the basic directions by azimuth.

CONDUCTING BARRAGE FIRE WITH TARGET HEADINGS OF 180° AND 0°

354. An azimuth is taken in the direction of the engine noise, an angle of elevation is assigned to allow for the altitude of the target (Item 338).

355. With machine guns with uneven numbers (1, 3), the barrel is shifted from the basic azimuth direction 3-00 to the right for the first burst, while machine guns with even numbers (2, 4) are shifted 3-00 to the left.

356. Beginning with the direction corrected 3-00, a zone of five short bursts at constant angle of elevation ( $30^\circ$  or  $60^\circ$ ) is set up for each machine gun with an azimuth shift of 1-50 after each burst. Machine guns with uneven numbers shift to the left, while machine guns with even numbers shift to the right (Fig.130).

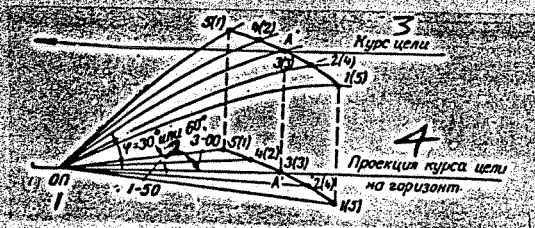


Fig. 130. Form and dimensions of barrage fire zone with target heading of  $0^\circ$  and  $180^\circ$ :

OP - 1,2,3,4,5 - directions of short bursts of machine gun fire;  $\wedge$  - angle of elevation.

Key: (1) OP (Fire Position); (2) or; (3) Target heading; (4) Projection of target heading to horizon

357. The angle of elevation given in the command is set visually or with the aid of wooden strips to hold the machine gun barrel at the commanded angle of elevation. Azimuth shifts of the machine guns are also made visual being guided by the distances between reference point indicators.

358. The command to open fire is given when the target is at a distance of 1600 m from the firing position. The command to open fire when the target is moving away from the firing position is given at the moment it is determined from the engine noise that the target is over the firing position (at the zenith).

#### CONDUCTING BARRAGE FIRE WHEN TARGET MOVES OBLIQUELY RELATIVE TO THE MACHINE GUN FIRING POSITION

359. Firing is conducted at ranges up to 1000 m when the target moves obliquely relative to the firing position of the platoon.

360. If the target is moving toward a defended objective, the platoon

commander assigns an azimuth direction so as to take into account that the vertical curtain of barrage fire will be placed between the defended objective and the target.

When the target is not moving toward the defended objective, an azimuth direction is assigned in the direction of the target heading so that the curtain of barrage fire will be placed ahead of the target.

361. Machine guns with uneven numbers shift the barrel from the basic direction in respect to angle of elevation up 2-00, while machine guns with even numbers shift down 2-00 in order to produce the first burst (Fig.131).

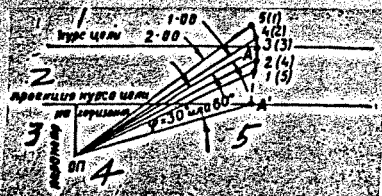


Fig. 131. Form and dimensions of zone of barrage fire when target moves obliquely relative to firing position: OP- 1,2,3,4,5 - directions of short bursts of fire;  $\gamma$  - angle of elevation.

Key: (1) Target heading; (2) Projection of target heading to horizon; (3) Parameter; (4) OP (Fire Position); (5) or

362. Beginning with the direction corrected 2-00, each machine gun sets up a vertical zone of five short bursts with a constant azimuth with shifts of the machine guns in angle of elevation after each burst: even numbered machine guns, - 1-00 up, and uneven numbered machine guns, - the same amount down.

Shifting of the machine guns in angle of elevation after each burst is done visually.

363. The command is given to open fire at the moment when the target is determined from the noise of the engine to be at a distance of up to 1600 m from the firing position.



## FIRING AT PARACHUTISTS AND FLARES

364. Firing at parachutists and flares is conducted with the anti-aircraft sight. An aiming point is selected on the outer surface of the hub of the ring sight so that the straight path of the descending parachutist (vertical or slanted) extended from the aiming point to the hub will pass through the center of the hub. The ring sight is set vertical (in respect to the weight-bob) (Fig.132).

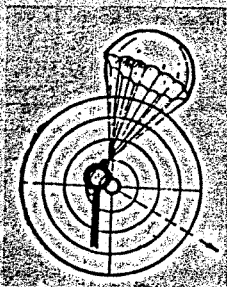


Fig. 132. Selection of aiming point when firing at a parachutist. The wind is carrying parachutist to the right

situation and nature of the target.

366. Firing is conducted in bursts or with continuous fire.

Continuous fire is used for warding off an attack or counterattack.

Fire in bursts is employed for destruction of targets which appear and move quickly, and also for registering and correcting fire.

367. Each machine gun opens fire on aerial targets as soon as ready.

Fire must be conducted as follows:

- at maximum ranges - in short bursts of 5-7 rounds;

Range to the parachutist is determined visually.

Fire is conducted in short bursts with armor piercing-incendiary-tracer bullets.

Fire correction is made by changing the aiming point.

When firing at flares, the gun is aimed at the point of illumination.

### SELECTING TYPE OF FIRE

365. The gunner is given the type of fire in the command. When firing independently, the gunner determines the type of fire himself depending on the



- at medium and short ranges - long bursts of 10-15 rounds;
- against diving aircraft and ground attack aircraft - continuously.

The gunner keeps the target on the commanded ring the whole time during firing. Interruptions of 1-2 seconds are made between bursts in order to refine the aim.

#### SELECTING THE MOMENT TO OPEN FIRE

368. It is most advantageous to open fire against ground targets when:

- the target can be hit unexpectedly for the enemy;
- the target presents the greatest possibility of destruction according to its dimensions;
- the target is easily visible;
- the enemy has compressed or supported his flank.

The commander determines the moment for opening fire and gives the appropriate command. The gunner determines the moment for opening fire when firing independently, depending on the situation and the nature of the target.

Opening fire at long ranges keeps the enemy under constant pressure, slows down his action, and inflicts losses.

Fire at short ranges, especially cross and flanking fire, is most effective. Such fire requires firm control and high firing discipline.

369. Firing at medium ranges is most effective against aerial targets.

#### OBSERVATION OF THE RESULTS OF FIRE AND ITS CORRECTION

370. All machine gunners must observe the results of fire of their own machine gun while firing and must correct it by making the necessary correction in sight setting and aiming point.

371. Results of fire are determined on the basis of observation of the place of impact of the bullets in relation to the target. In this case, the place of impact of the greater number of bullets is taken since it shows the

position of the center of dispersion.

372. During firing, tracer bullets show by their path the various deflection relative to the target both in magnitude and in direction. Therefore, the deflection of a tracer bullet is determined only at the moment it reaches the target.

A lateral observation point is used when firing at ranges greater than 500 to observe the track.

Fire is opened with the use of tracer bullets with the commander's permission.

When loading the belt, the cartridges with tracer bullets are placed in among the other bullets in a ratio of 1 to 4 or 1 to 3.

373. The following are used as signs of effectiveness of fire:

Against ground targets:

- visible destruction of the target;
- rapid movement of the target to cover, confusion in the enemy ranks;
- weakening in the force and effectiveness of enemy fire or his complete ceasing of fire.

Against aerial targets:

- destruction of the target;
- sharp turns of the target immediately after the track passes close to it;
- normal grouping of the tracks near the target.

When firing tracking fire, that grouping of tracks is considered normal in which the average cone of trajectories intersects the engine group of the aircraft or passes in front of the aircraft on a course no more than one body length of it.

374. The machine gunners report the results of firing to the commander when firing under the direction of the commanders as follows:

- if the bullets lie equally both ahead of and behind the target, - "Good";
- if the bullets lie ahead of the target, - "Short, so many meters";
- if the bullets lie behind the target, - "Over, so many meters";
- if the bullets are deflected to one side, - "To the right (left), so many (thousandths, figures, fingers, and so forth)".

375. The commander orders corrections in sight setting and change in aiming point.

In order to correct fire, the command is given:

- for a change in elevation: "Stop, rear sight such and such".
- for a change in traverse: "Stop, backsight right (left) so much" or in the absence of a backsight: "Stop, right (left) 0-12 (two fingers, the width of the hedge, and so forth)".

Correction is applied in the event of systematic and one-sided deflection of the cone of fire relative to the target in two or more bursts.

Correction of trajectories lagging behind (leading) in respect to the target is accomplished by increasing (decreasing) the entry velocity for firing by 50 km/h.

Correction of vertical deflections when the target is moving obliquely is accomplished by changing the range: if the average trajectory passes beneath (above) the target, the range is increased (decreased) 200 m relative to the last determined range.

Correction of lateral deflections with course angles close to  $0^{\circ}$  or  $180^{\circ}$  is accomplished by changing the aiming point on the ring: if the average trajectory passes right (left) of the target, the aiming point is selected corresponding to the amount of deflection of the track to the right (left) of the vertical spoke of the ring sight.

When firing curtain fire, correction is made along the course by a simultaneous change of two commanded speeds. If all tracks of two bursts pass in back of (ahead of) the target, for the model 1941 sight, the ring to be commanded corresponds to speeds 125 km/h faster (slower) than those at which firing was conducted; and for model 1936 and 1938, rings are commanded corresponding to speeds 100 km/h faster (slower) than those at which firing was conducted.

376. During independent conduct of fire, the gunner independently corrects fire in accordance with results of observation, applies the necessary correction to the sight and changes the aiming point.

## FIRING ON STATIONARY TARGETS

377. Stationary targets are fired upon:

- with pin-point fire - at ranges up to 1000 m if registration fire has been previously conducted;
- with fixed pin-point fire - at ranges up to 600 m if the distance has been accurately determined and external conditions learned, and also with conduct of registration fire.

378. The machine gun is aimed at the near or far edge of the target (line). When a group of machine guns are firing, some are aimed at the far edge, and the rest, at the near edge.

## FIRING ON TARGETS WHICH SUDDENLY APPEAR AND ARE QUICKLY CONCEALED

379. In order to destroy targets which suddenly appear and are quickly concealed, it is necessary to:

- observe the battlefield attentively and continuously;
- quickly locate and evaluate the targets and determine the distances to them;
- quickly prepare data for firing and issue the commands;
- quickly and accurately carry out the commands given.

380. In order to destroy targets which appear and are quickly concealed, aim the machine gun beforehand at the place where a target is expected to appear. When the target appears, quickly refine the aim and open fire.

## FIRING ON MOVING TARGETS

381. Fire is conducted against moving targets by leading them.

a) When the target is moving in the plane of fire (toward or away from you) take a lead:

- when firing at targets on foot moving at a speed of 3 m/s, - one sight graduation;



- when firing at motorized targets moving at a speed of 4-6 m/s, -two sight graduations.

b) When firing at rapidly moving targets, aim under the target, using the range for direct fire, for example, open fire on an antitank gun on a prime mover with sight 6, and on an armored personnel carrier, -with sight 8.

c) When firing on targets moving on a forward slope, and also when firing down from above, the sight is increased.

d) When firing on targets moving on a reverse slope, and when firing up from below, the sight is decreased.

e) When the target moves at  $90^\circ$  to the plane of fire, a lateral lead is taken in accordance with the following table:

Range in meters \ Speed in km/h	10	15	25
	Lead in deflection angle graduations (thousandths)		
From 100 to 800	0-04	-	-
From 100 to 400	-	0-05	-
From 500 to 800	-	0-06	-
To 200	-	-	0-08
From 300 to 500	-	-	0-09
From 600 to 800	-	-	0-10

Remarks. 1. In addition to the data in Item 381, follow the data in Table 3 (Appendix 3).

2. With course angles of  $30^\circ$ ,  $45^\circ$ , and  $60^\circ$ , leads of 0.5, 0.7, and 0.9 are taken respectively from the corrections provided in the table.

382. Fire on moving targets is conducted in short bursts.

The horizontal lead with oblique movement of the target is computed by moving the aiming point forward in the direction of movement of the target, at speeds up to 20 km/h - by 1/2 the body of the target (armored transporters, motor vehicles), and with speeds from 20 to 40 km/h - by 1 body.

383. Firing can be conducted against moving ground targets with the anti-



aircraft sight by selecting an aiming point on the horizontal spoke of the ring sight corresponding to the speed and aspect ratio of the target.

384. Targets moving at an angle to the plane of fire are fired upon:

- continuously, accompanying the target with fire;
- by creating an interdiction barrage at previously noted points on the path of movement of the target.

385. In order to accompany the target with fire smoothly and without breaks, direct the machine gun in the direction of movement of the target without squeezing the grips of the back plate and conduct continuous fire.

386. In order to create an interdiction barrage:

- note on the terrain several aiming points along the path of movement of the target;
- determine the sight for firing on each of the noted aiming points;
- bring the machine gun to bear on the first of the noted aiming points and open fire when the target reaches it.

Decrease or increase the lead by observing the deflection of the bullets relative to the target.

The best method of correcting fire when firing on a rapidly moving target is the use of tracer bullets.

#### FIRING ON INVISIBLE AND CAMOUFLAGED TARGETS

387. In order to fire on a target which is not visible to the gunner, select an easily visible aiming point at the concealed range and same height as the target. Set the sight to correspond to the distance to the target. Bring the machine gun to bear on the aiming point selected on the concealment.

388. If the target is camouflaged and not clearly visible or hidden behind a screen which can be penetrated by bullets (fence, brush, grass, smoke), aim the machine under the lower edge of the line or screen.

## FIRING IN BETWEEN AND BEYOND THE FLANK OF FRIENDLY UNITS

389. When conducting fire in between and beyond the flank of your own units the following rules are observed:

a) When firing, eliminate the possibility of bullets hitting or ricocheting close to the locations of your own units. For this, do not conduct fire when the distance between the target and your own units is less than 300 m. In defense, when there are deep trenches, this distance can be shortened considerably. There must not be elevated local objects which could cause bullets to ricochet in the direction of fire close to one's own units.

b) There must be a space, equal to the safety angle (Fig. 133), between the flanks of one's own units for safety in firing in between units. The safety angle is measured in thousands. Its size depends on the distance one's own units are away from the machine gun. In an offensive, the safety angle is double. Safety angles are measured with the binocular reticle (Fig. 134), a millimeter scale on a ruler, improvised objects, and the fingers held 50 cm from the eye (Fig. 135).

390. The size of the safety angle is computed when firing at a given distance in order to determine the possibility of conducting fire in between one's own units and to determine the limits of transferring fire along the front. The boundaries of the angles in the area of the location of the target are established according to the terrain. The limits of fire transfer are limited when firing with a transfer of fire along a front.

391. When firing in between and beyond the flank of one's own units, observation must be especially carefully made of the impact spot of one's own bullets, the results of fire, and also the advance and signals of one's own unit

Fig. 133. Safety angle when firing in

between and beyond the flank of one's

own units:

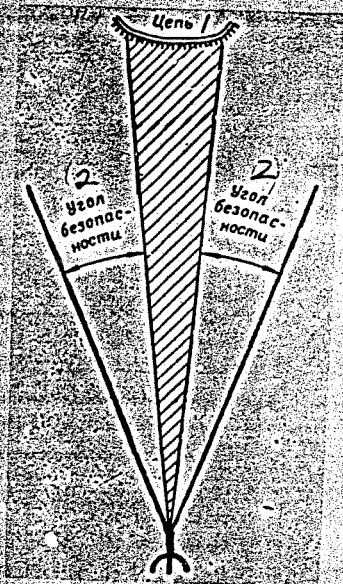


Fig. 133. Safety angle when firing in between and beyond the flanks of one's own units

Key: (1) Target; (2) Safety angle

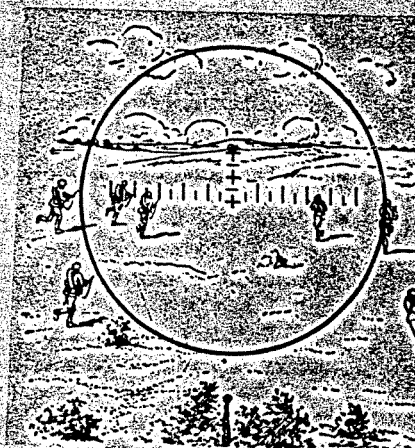


Fig. 134. Determining possibility of firing in between units, using the binocular reticle



Fig. 135. Position of fingers when determining safety angles while conducting fire in between and beyond the flanks of one's own units.

Key: (1) thousandths

## FIRING AT NIGHT AND UNDER CONDITIONS OF LIMITED VISIBILITY

392. Firing under conditions of limited visibility (in fog, smoke, and so forth) is conducted at ranges up to 800 m. The gunner must use point blank range and conduct fire without changing the sight.

393. Firing at night with artificial illumination of the target (by searchlight, by rocket) is performed under the same rules as by day.

By daylight, it is necessary to determine the distance to the lines at which the appearance of the enemy is possible.

In advance of illumination of the terrain, look in the direction of the assumed appearance of the target.

During illumination, quickly find the target, aim the machine gun, and fire one or several bursts depending on the length of time of illumination. During illumination, don't look at the source of the light (rocket, searchlight) in order to avoid temporary blindness.

394. Firing by night without artificial illumination, and also when one's own troops are screened with smoke, and in fog requires prior preparation by daylight of one of the following methods.

### First method.

- a) Aim the machine gun well in advance at the indicated (selected) line with the sight set for the distance corresponding to this line.
- b) Set a stake with a light or other luminous source 15-20 m in front of the machine gun and in line with the target.
- c) The sight setting to the light is noted.
- d) Make note of the limits of transfer of fire along the front:
  - aim the machine at the right edge of the line;
  - lock the traversing mechanism and hammer a small stake into the ground on the right side of the barrel (to limit shifting fire to the right);
  - aim the machine gun at the left edge of the line;
  - lock the traversing mechanism and hammer a small stake into the ground on the left side of the barrel (to limit shifting fire to the left).



e) If it is necessary to temporarily remove the machine gun from the firing position after preparing the data, mark the place of the wheels and trails accurately with sticks for subsequent accurate setting of the machine gun in the marked place in darkness.

Second method.

a) Aim the machine gun at the right and left edges of the line along which it is proposed to conduct fire at night. Install and secure the limiters correspondingly.

b) Set the body of the machine gun horizontal (visually). Aim the machine gun with the sight and backsight set corresponding to the distance to the line. Set the sighting ring on the zero mark on sights manufactured from 1938 to 1940. Remember (record) the ring setting obtained when aiming.

Note. The angle of elevation of the machine gun for firing on the line determined by the following method (for machine guns with mounts manufactured from 1938 to 1940):

1. Using the goniometer scale (binocular reticle), measure the angle of sight of the target (line).

2. Determine the angle of elevation of the machine gun in sighting ring graduations for firing on the given line. To do this, add to the sighting angle in thousandths (if the angle of sight of the target is positive) or subtract (if the angle of sight of the target is negative) the angle of sight of the target in thousandths. Convert the obtained angle into graduations of the sighting ring with corrections for meteorological conditions.

3. Set the body of the machine in a horizontal position (visually). Set the sight ring on zero. After this, set the machine gun by the ring on the angle of elevation found.

Example. The distance to the line is 800 m. Bullets are B-32. Angle of elevation is 8.1 thousandths (Table 1). Measured angle of sight of the target is 6 thousandths. Angle of elevation is equal to 14.1 thousandths ( $8.1 + 6 = 14.1$ ), which corresponds to ring graduation 12.

395. Preparation for firing on two or several lines is performed according to the methods described in Item 394. All directions are marked by stakes or appropriate inscriptions on the shield.



396. If the data for firing under conditions of limited visibility have not been prepared well in advance, then firing without artificial illumination must only be opened to counter an enemy attack according to the visible silhouettes.

397. Firing through a smoke screen without preliminary preparation is conducted directly at the smoke screen, like a camouflage cover, with transfer of fire along the front the width of the indicated line.

398. Firing at twilight and on a bright (moonlit) night is conducted according to the same rules as for day firing.

### FIRING IN MOUNTAINS

399. The range of flight of a bullet is increased when firing in mountains, as a result of the reduced density of the air.

If the elevation of the terrain does not exceed 500 m above sea level, the change in range of flight of the bullet is insignificant when firing at distances up to 500 m.

Sight corrections are made during actions in high mountain regions and with considerable angles of sight.

400. Pay special attention during actions in mountains to careful building of firing positions which must provide the capability of firing at high angles of elevation and ease of action with a machine gun.

### CONDUCTING CLOSE-IN FIRING

401. The machine gun can be used for conducting close-in firing in defense. Close-in "pin-point" fire is conducted with a range of 400 m on level ground and 300 m on broken terrain against infantry, moving guns and armored personnel carriers.

Fire is conducted from carefully screened firing positions. Machine guns for close-in firing are not called upon to fulfil other missions.

402. Fire is opened at the command or a sign from the section commander, and also independently by the gunner with the appearance of a target in the given direction or on the given line.

#### REGISTRATION FIRE

403. Registration fire is conducted in order to determine correct sight setting to ensure destruction of the target. Registration fire is performed: well in advance, - on reference points and lines, and in the course of battle, - directly at the target. Registration fire is employed when firing at ranges greater than 800 m and when targets (reference points) are located on facing slopes - at ranges greater than 500 m.

404. When observation is hampered, registration fire is conducted with armor piercing-incendiary- tracer bullets. Registration fire is conducted with careful and constant observation. Results are determined according to the location of the center of dispersion.

405. When several machine guns are located in the same firing position, registration fire is conducted with one machine gun. In order to insure rapid opening of fire in case of a stoppage of the machine gun doing the firing, the commanders of the non-firing machine guns receive all the officer's commands and carry them out accurately but do not open fire.

Registration fire is considered completed when the target is covered by the center of dispersion.

406. Registration fire is conducted:

- with bracketing of the target or
- with approach to the target in bounds.

407. Registration fire with target bracketing is employed against a static target when it is possible to observe rounds which are short and over.

When conducting registration fire, the initial sight setting is assigned to correspond to the distance determined to the target with consideration of corrections for meteorological conditions.

Registration fire is conducted in bursts of fixed fire at a point. When visibility is poor at the point of impact, firing is repeated at the same sight setting. After obtaining observation of the first burst (short, over), change the elevation by two sight graduations in order to bracket the target. With clear visibility of slight overs (shorts), the elevation is changed by one graduation in one direction or the other.

After the target has been bracketed, a change is made to fire for effect with a sight setting equal to the center sighting for the given bracket.

Example. Sight 10 - short, sight 12 - over. Sight for fire for effect - 11.

The correctness of the sight setting found is verified by a ranging burst.

A change in traverse on the basis of observation is made upon the command (approximately) "Right one hand".

In order to conduct registration fire, add the word "Registration" to the usual command.

Example. "At the plowed field, 10, aim at the right corner of the field, registration, one burst, -Fire".

408. Registration by approach to the target in bounds is conducted in the case of ability to observe bullet impact only in front of or beyond the target.

For the purpose of obtaining information on shorts or overs, registration fire is begun with the sight setting two or three graduations lower (higher) than that which corresponds to the determined firing range.

Registration fire is conducted with bursts of fixed fire at a point.

The gunner makes a one graduation change in elevation independently.

He corrects traverse in the process of registration firing.

Firing is continued until the command "Stop" which is given when it is clear that the burst has covered the target.

The sight setting found by registration is verified by a ranging burst.

Commands for registration fire are the usual ones given with the addition:

"Registration by bounds forward (backward)".

Example. "On such and such line (target), aim is such and such, registration by bounds forward, in bursts, - Fire".

#### PREPARATION OF DATA FOR FIRING

409. Preparation of data for firing is made beforehand or immediately before opening fire. It ensure the commander and gunner of rapid and successful accomplishment of fire missions.

410. Preparation of data for firing includes:

- determination of sight (backsight) setting;
- determination of ammunition expenditure to accomplish the mission.

411. Initial data for determining the sight (backsight) are: distance to the target, correction for meteorological conditions, and correction for movement of the target, and angle of elevation of the target when firing direct fire in mountains.

412. If the situations permits, registration fire should be conducted on reference points and lines.

413. The section commander records (remembers) the preparatory data for firing, and when necessary announces them to the soldiers. After registration fire, he records the corrections in writing.

414. Preparatory data are applied to the range card (Fig.136) in defense. The section commander(platoon commander) prepares an antiaircraft range card (see Fig.125) for firing against enemy aircraft. The distances to the reference points on the antiaircraft range card must be known by heart.

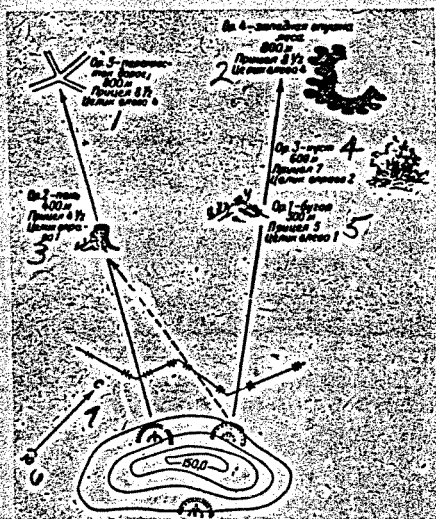


Fig. 136. Range card

Key: (1) Position 5 - Road intersection 800m. Sight  $8\frac{1}{2}$ . Backsight left 4; (2) Position 4 - West border of woods 800 m. Sight  $8\frac{1}{2}$ . Backsight left 4; (3) Position 2- Tree stump 400 m. Sight  $4\frac{1}{2}$ . Backsight right 1; (4) Position 3- Bush 600 m. Sight 7. Backsight left 2; (5) Position 1- Hillock 500 m. Sight 5. Backsight left 1; (6) N; (7) S

#### AMMUNITION SUPPLY

415. Combat requires a heavy expenditure of ammunition, lubricants, and everything needed for taking care of weapons. This requires commanders to carefully think out and organize a timely and steady supply for the machine guns.

416. Ammunition and everything necessary for conducting fire are delivered to machine gun sections and platoons by bearers with the combat supply points indicated to them.



417. Before an assault, the commander of the subunit receives an order regarding the route for transferring the combat supply point and the location of this point depending on the advance of the subunits.

418. In defense, alternate ammunition and firing positions are created ( in niches and cellars).

#### MAINTENANCE OF FIRE DISCIPLINE

419. Fire discipline includes accurate execution of all the fire command and orders of the commander.

Each commander is obliged to maintain fire discipline by all means possible. He must:

- maintain his self possession and calmness, especially during actions close to the enemy;
- constantly and attentively watch over the timely and accurate execution of fire commands, methods, and rules of firing by his subordinates.

420. At the slightest signs of weakening of fire discipline ( ragged firing, slackening of firing, not firing at the targets indicated, non- execution of commands regarding sight setting, backsight setting, ceasing fire without appropriate commands, and so forth), the commander must immediately take forceful measures to restore order.

In so doing, he must halt the firing, bring order to the unit, and again give the command and continue to fire.

## Appendix 1

### LIST OF TERMS USED IN THESE INSTRUCTIONS

Course parameter - the shortest distance from the machine gun to the course of the aircraft projected to the horizon.

Aircraft heading - the direction of movement of an aircraft.

Target aspect ratio - the ratio of the length of an aircraft fuselage as seen by an observer to its true length.

Course angle - the angle between the heading of the aircraft and the line of sighting.

Angle of target elevation - the angle between the line of position of the target and the horizontal line of the machine gun.

Aiming point - the point on the ring of the front sight (or between rings) through which the sighting line passes.

Linear lead - the track covered by an aircraft during the flight time of a bullet to it.

Sighting line (aiming line) - the line going from the eye of the gunner through the center of the rear peep-hole, the rim of the ring (between rings) of the front sight and to the nose of the target.

Line of position - the straight line connecting the machine gun with the target.

## Appendix 2

### PURPOSE AND CONSTRUCTION OF THE UNIVERSAL LYRE

The lyre is designed for determining the range to an aircraft.

The lyre consists of the following parts (Fig.137):

- a fixed ruler with range scale in hundreds of meters (sight graduations 4, 5, 6, 7, 8, 10, 12, 14, 16, 18, 20, and 24; length of ruler is 20 cm, the width - 10-15 mm;
- an arc with a scale of aircraft dimensions in meters; length of the arc is 9 cm, width - 10-15 mm, radius of external circumference counted from the axis of rotation of the ruler - 20 cm;
- a movable ruler with range scale, indicator, and opening for the axis of rotation; length of the ruler from axis of rotation to external circumference of the arc is 20 cm, width - 10-15 mm;
- a pin for rotation of the movable ruler and the handle of the lyre.

The lyre is <sup>MADE</sup> out of rigid or heavy thick cardboard (1-1.5 mm). The lyre handle, the fixed ruler, and the arc are made from a single piece of tin or cardboard.

Figure 137 shows a lyre in  $\frac{1}{2}$  actual scale, therefore each dimension must be doubled when making it.

The lyre is held at a distance of 60 cm from the eye when determining the range to an aircraft.

Appendix 2  
contd.

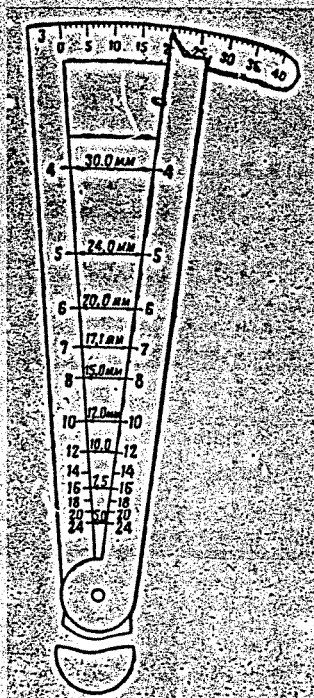


Fig. 137. Lyre

## Appendix 3

### FIRING TABLES FOR 12.7-mm MACHINE GUN MODELS 1938/46 and 1938 ON UNIVERSAL MOUNT, MODEL 1938

#### Explanation of Firing Tables

1. The data included in the tables for firing under the following conditions are taken as normal:

- the target is located on the horizontal line of the weapon (angle of elevation of target is equal to zero);
- there is no lateral inclination of the machine gun;
- atmospheric pressure at the level line of the machine gun is 750 mm;
- air temperature at the level line of the machine gun is  $+15^{\circ}\text{C}$ ;
- relative humidity of the air is 50%, which corresponds to normal air density of  $1206\text{ kg/m}^3$ ;
- terrain elevation above sea level is 110 m;
- no wind (calm);
- average bullet weight and initial velocity are equal to the tabulated designations of these values;
- charge temperature is  $+15^{\circ}\text{C}$ ;
- machine guns - category one.

2. The values of angles of sight in thousandths are indicated with allowance for angle of jump.

3. Dispersion of trajectories is given in the form of mean deviations and centralized zones.

Mean (probable) error is equal to one half the width of the central zone which includes 50% of all hits.

The centralized zone includes 70% of all bullet hits.



## Appendix

Table 1

Основная таблица (элементы траектории)

Угол вылета равен

2

пули Б-32 (вес 48,3 г) и БЗТ-44 (вес 43,9 г)

минус 3 минуты

Начальная скор  
820 м/сек

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Table 1

contd.

Key: (1) Basic table (elements of trajectory) for bullets (B-32 (weight 43.3 g) and BZT-44 (weight 43.9 g); (2) Angle of jump equals minus 3 minutes; (3) Initial velocity 820 m/s; (4) Range; (5) Angle of sight; (6) Angle of fall; (7) Height of trajectory; (8) Horizontal range to summit of trajectory; (9) Total flight time; (10) Terminal velocity of bullet at target; (11) Energy of bullet at target; (12) B-32 bullet; (13) Mean deviation; (14) in range; (15) in height; (16) lateral; (17) Centralized zones; (18) in range; (19) in height; (20) lateral; (21) BZT-44 bullet; (22) Mean deviation; (23) in range; (24) in height; (25) lateral; (26) Centralized zones; (27) in range; (28) in height; (29) lateral; (30) Danger space factor; (31) Range; (32) degrees, minutes; (33) thousandths; (34) seconds; (35) m/s; (36) kgm.

## Table 2

Key: (1) Excess of trajectory over line of sighting of B-32 bullets (weight 48.3 g) and BZT-44 bullets (weight 43.9 g); (2) Initial velocity 820 m/s; (3) Range in meters; (4) Sight graduation; (5) centimeters; (6) meters.

## Appendix

Table 3

1 Поправки в тысячных на перемеще

Пули Б-32 (вес 48,3 г)

иные пули за время полета пули

и БЗТ-44 (вес 43,9 г)

3 Начальная скорость  
820 м/сек

Дальность в м	6 Конная цель			10 М о т о			9 25 35 45 60 км/час					Дальность в м
	счетом 2 м/сек	7 рысью 4 м/сек	8 галопом 8 м/сек	9 10 км/час	15 км/час		9 25 км/час	35 км/час	45 км/час	60 км/час	90 км/час	
4	11 Всадники поперек						100 в тысячных					4
1	2	3	4	5	6		7	8	9	10	11	12
100	2,3	4,6	9,2	3,2	4,8		8,0	11,1	12,7	15,9	19,1	100
200	2,4	4,8	9,5	3,3	5,0		8,3	11,6	13,3	16,6	19,9	200
300	2,5	5,0	9,9	3,4	5,2		8,6	12,1	13,8	17,2	20,7	300
400	2,6	5,2	10,3	3,5	5,4		8,9	12,5	14,3	17,8	21,4	400
500	2,6	5,3	10,6	3,6	5,5		9,2	12,9	14,7	18,3	22,0	500
600	2,7	5,4	10,8	3,7	5,6		9,4	13,2	15,0	18,8	22,5	600
700	2,8	5,5	11,0	3,8	5,7		9,6	13,5	15,3	19,2	23,0	700
800	2,8	5,6	11,2	3,9	5,9		9,8	13,8	15,6	19,6	23,5	800
900	2,9	5,7	11,5	4,0	6,1		10,0	14,1	16,0	20,1	24,0	900
1000	3,0	5,9	11,8	4,1	6,2		10,3	14,4	16,4	20,6	24,6	1000
1100	3,1	6,1	12,1	4,2	6,3		10,6	14,8	16,9	21,2	25,3	1100
1200	3,2	6,3	12,5	4,3	6,5		10,9	15,2	17,4	21,8	26,1	1200
1300	3,3	6,5	13,0	4,5	6,7		11,3	15,7	18,0	22,5	27,0	1300
1400	3,4	6,7	13,5	4,7	7,0		11,7	16,2	18,6	23,3	28,0	1400
1500	3,5	6,9	14,0	4,8	7,2		12,1	16,8	19,3	24,1	29,0	1500
1600	3,6	7,1	14,4	5,0	7,5		12,5	17,4	20,0	25,0	30,0	1600
1700	3,7	7,4	14,8	5,2	7,7		12,9	18,0	20,7	25,8	31,0	1700
1800	3,8	7,7	15,3	5,4	8,0		13,3	18,6	21,3	26,6	32,0	1800
1900	3,9	7,9	15,8	5,5	8,2		13,7	19,2	21,9	27,4	32,9	1900
2000	4,0	8,1	16,2	5,6	8,4		14,1	19,7	22,5	28,1	33,8	2000
2100	4,2	8,3	16,6	5,7	8,6		14,4	20,2	23,1	28,8	34,7	2100
2200	4,3	8,5	17,1	5,8	8,9		14,8	20,7	23,7	29,6	35,6	2200
2300	4,4	8,7	17,5	6,0	9,1		15,2	21,2	24,3	30,4	36,5	2300
2400	4,5	9,0	17,9	6,2	9,3		15,5	21,8	24,9	31,2	37,4	2400
2500	4,6	9,2	18,4	6,4	9,6		15,9	22,3	25,5	31,9	38,3	2500
2600	4,7	9,4	18,8	6,5	9,8		16,3	22,8	26,1	32,6	39,1	2600
2700	4,8	9,6	19,2	6,6	10,0		16,6	23,3	26,6	33,2	39,9	2700
2800	4,9	9,8	19,6	6,8	10,2		16,9	23,7	27,1	33,8	40,7	2800
2900	5,0	10,0	19,9	6,9	10,4		17,3	24,1	27,6	34,5	41,5	2900
3000	5,1	10,1	20,2	7,0	10,5		17,6	24,6	28,1	35,2	42,3	3000
3100	5,2	10,3	20,6	7,1	10,7		17,9	25,1	28,6	35,8	43,0	3100
3200	5,2	10,5	21,0	7,3	10,9		18,2	25,5	29,1	36,4	43,7	3200
3300	5,3	10,7	21,3	7,4	11,1		18,5	25,9	29,6	37,0	44,4	3300
3400	5,4	10,9	21,7	7,5	11,3		18,8	26,4	30,2	37,7	45,2	3400
3500	5,5	11,1	22,1	7,7	11,5		19,2	26,9	30,8	38,4	46,1	3500

Key: (1) Corrections in thousandths for motion of target during flight of bullet; (2) B-32 bullet (weight 48.3 g) and BZT-44 (weight 43.9 g); (3) Initial velocity 820 m/s; (4) Range in meters; (5) Mounted target; (6) walk 2 m/s; (?) trot 4 m/s; (8) gallop 8 m/s; (9) km/h; (10) Motorized target; (11) corrections in thousandths



## Appendix

Table 4

Количество патронов, необходимое для поражения цели одним попаданием							
2 Пуля БЗТ-44 (вес 43,9 г)							
Дальность м	4 Пулемет (мешок № 10)	5 Противотан- ковое орудие (мешок № 11)	6 Танк (мешок № 12)	7 Танк (мешок № 12)	8 Бронетранс- порт (мешок № 13)	9 Бронетранс- порт (мешок № 13)	Дальность м
3	II. Количество патронов						3
1	2	3	4	5	6	7	8
100	1	1	1	1	1	1	100
200	2	1	1	1	1	1	200
300	4	1	1	1	1	1	300
400	6	2	1	1	1	1	400
500	9	2	2	2	1	1	500
600	12	3	2	2	2	1	600
700	16	4	3	3	2	2	700
800	22	5	4	3	3	2	800
900	30	6	5	4	3	2	900
1000	38	7	6	4	4	3	1000
1100	47	9	7	5	5	3	1100
1200	58	11	8	5	5	3	1200
1300	71	12	10	6	6	4	1300
1400	87	16	12	7	7	4	1400
1500	107	19	14	8	9	5	1500
1600	132	23	17	10	11	6	1600
1700	163	28	21	12	13	7	1700
1800	202	34	25	15	16	8	1800
1900	250	41	30	18	19	10	1900
2000	308	50	37	21	23	12	2000
2100	377	61	45	25	28	15	2100
2200	458	74	54	30	34	18	2200
2300	551	90	65	36	41	21	2300
2400	656	109	78	44	49	24	2400
2500	773	131	93	53	58	28	2500
2600	—	156	110	63	68	33	2600
2700	—	184	129	74	79	39	2700
2800	—	215	151	86	92	46	2800
2900	—	248	176	99	106	53	2900
3000	—	233	205	114	122	61	3000

10 Пуля Б-32 (вес 48,3 г)							
Дальность м	4 Пулемет (мешок № 10)	5 Противотан- ковое орудие (мешок № 11)	6 Танк (мешок № 12)	7 Танк (мешок № 12)	8 Бронетранс- порт (мешок № 13)	9 Бронетранс- порт (мешок № 13)	Дальность м
3	II. Количество патронов						3
1	2	3	4	5	6	7	8
100	1	1	1	1	1	1	100
200	1	1	1	1	1	1	200
300	2	1	1	1	1	1	300
400	4	1	1	1	1	1	400
500	6	2	1	1	1	1	500
600	8	2	2	2	1	1	600
700	11	2	2	2	2	1	700
800	17	3	2	2	2	1	800
900	20	4	3	2	2	1	900
1000	26	5	4	3	3	2	1000
1100	33	6	4	3	3	2	1100
1200	41	7	5	4	4	2	1200
1300	50	8	6	4	4	3	1300
1400	58	10	7	5	5	3	1400
1500	68	12	9	5	6	3	1500
1600	79	14	10	6	7	3	1600
1700	93	16	12	7	8	4	1700
1800	110	18	14	8	9	4	1800
1900	130	21	16	9	10	5	1900
2000	150	25	18	10	11	6	2000
2100	172	28	20	12	12	6	2100
2200	195	32	22	13	14	7	2200
2300	219	37	24	15	15	8	2300
2400	244	41	27	17	17	9	2400
2500	270	45	29	18	19	10	2500
2600	296	50	33	20	21	11	2600
2700	323	55	37	23	23	12	2700
2800	351	60	42	25	26	13	2800
2900	387	65	48	27	28	14	2900
3000	430	71	54	30	31	16	3000
3100	476	77	60	33	34	18	3100
3200	527	84	68	37	38	20	3200
3300	580	91	72	41	42	22	3300
3400	638	100	79	45	46	24	3400
3500	826	114	86	50	52	26	3500

Key: (1) Number of rounds required for destruction of target in one strike;  
(2) BZT-44 bullet (weight 43.9 g); (3) Range in meters; (4) Machine gun (target No. 10); (5) Antitank gun (target No. 11); (6) Tank (target No. 12); (7) Tank (target No. 12a); (8) Armored personnel carrier (target No. 13); (9) Armored personnel carrier (target No. 13a); (10) B-32 bullet (weight 48.3 g).  
(11) Number of rounds

## Appendix

### Notes to Firing Tables

1. One graduation of the goniometer (thousandth) is equal to 3.6 minutes.

2. Corrections:

Cross wind from the right - correction is to the right.

Cross wind from the left - correction is to the left.

- range head wind - correction is plus (add);

- range tail wind - correction is minus (subtract).

Pressure is higher than normal - correction is plus (add).

Pressure is lower than normal - correction is minus (subtract).

Temperature is higher than normal - correction is minus (subtract).

Temperature is lower than normal - correction is plus (add).

Initial velocity is greater than shown in table - correction is minus (subtract).

Initial velocity is less than shown in table - correction is plus (add).

Temperature of charge is higher than shown in table - correction is minus (subtract).

Temperature of charge is lower than shown in table - correction is plus (add).

3. Correction for drift - always left. Correction for drift is not applied when firing since the sight calculates it automatically.

## TABLE OF CONTENTS

Introduction .....	
Basic machine gun data .....	

### PART I

#### CONSTRUCTION OF THE 12.7-mm MACHINE GUN, MODEL 1938/46, ITS HANDLING, STORAGE, AND MAINTENANCE

Chapter I. Understanding the Construction and Operation of the 12.7-mm Machine Gun, Model 1938/46 .....	
General Aspects .....	
Construction of the Cartridge .....	

Chapter II. Disassembly and Assembly of the Machine Gun .....	
General Directions.....	
Partial Disassembly of the Machine Gun.....	
Assembly of the Machine Gun After Partial Disassembly .....	
Complete Disassembly of the Machine Gun .....	
Assembly of the Machine Gun After Complete Disassembly .....	
Disassembly and Assembly of the Mount, Model 1938 for the Machine Gun, Model 1938/46.....	
Replacing the Barrel .....	
Use of the Gas Regulator .....	

Chapter III. Maintenance and Storage of the Machine Gun .....	
General Directions .....	
Cleaning and Lubrication of the Machine Gun.....	
Rules for Storage and Maintenance of the Machine Gun .....	
Under Various Conditions .....	

### Chapter

Chapter IV. Function and Construction of the Parts and Mechan- isms of the Machine Gun.....	
Barrel .....	
Receiver Housing .....	

Rear Sight .....	
Bolt Support .....	
Bolt .....	
Trigger Housing .....	
Back Plate .....	
Receiver .....	
Kolesnikov Universal Mount, Model 1938 .....	
Metallic Belt and Box for It .....	
Accessories for the Machine Gun .....	
Chapter V. Interaction of Parts and Mechanisms of the	
Machine Gun .....	
Position of Parts and Mechanisms of the Machine Gun	
Before Charging .....	
Operation of Parts and Mechanisms of the Machine Gun	
in Charging .....	
Operation of Parts and Mechanisms of the Machine Gun	
During Firing .....	
Position of Parts and Mechanisms of the Machine Gun	
After Temporary Fire Halt and During Unloading.....	
Chapter VI. Disruption of Normal Operation of Machine Gun	
Mechanisms .....	
General Measures to Prevent and Eliminate Stoppages	
During Firing .....	
Typical Malfunctions Causing Stoppages During Firing ...	
Chapter VII. Inspection and Preparation of the Machine	
Gun for Firing .....	
General Regulations .....	
Inspection of the Machine Gun by the Gunner and	
Section Commander .....	
Inspection of the Machine Gun in Assembled Form .....	
Inspection of the Machine Gun in Disassembled Form ....	
Preparing the Machine Gun for Firing .....	



Chapter VIII. Test Aiming and Zeroing-in of Machine Guns .....

General Regulations .....

Test Aiming of Machine Guns with Original Barrel.....

Test Aiming of Spare Barrels and Marking Them .....

Defects of a Machine Gun Disrupting Its Zeroing-in .....

Chapter IX. Structural Features of the Model 1938 DShK

System Machine Gun and Their Handling .....

Construction and Purpose of Parts and Mechanisms of the  
Machine Gun .....

Description of Parts of the Model 1938 Machine Gun

Which Differ from Parts of the Model 1938/46

Machine Gun .....

Handling the Model 1938 Machine Gun .....

PART II

ANTI-AIRCRAFT SIGHTS, MODEL 1943, 1938, AND 1941 FOR  
12.7-mm MACHINE GUN, MODEL 1938/46 AND MODEL 1938

Chapter X. Antiaircraft Sight, Model 1943 .....

Combat Properties and Function of the Antiaircraft

Sight, Model 1943 .....

Main Parts of the Antiaircraft Sight .....

Assembly and Disassembly of the Antiaircraft Sight on the  
Machine Gun .....

Operating the Sight .....

Storage and Care of the Antiaircraft Sight .....

Aspect Ratio-Range Finder and its Operation.....

Chapter XI. Construction of the Antiaircraft Sight, Model 1938.

Model 1938 .....

Antiaircraft Sight, Model 1938 for the 12.7-mm

Machine Gun, Model 1938 .....

Construction of the Antiaircraft Sight.....	
Handling the Antiaircraft Sight, Model 1938 .....	
Adjustment of the Antiaircraft Sight .....	
Maintenance and Care of the Antiaircraft Sight .....	

Chapter XII. Antiaircraft Sight, Model 1941.....	
Purpose and Specifications of the Antiaircraft	
Sight, Model 1941.....	
Construction of the Antiaircraft Sight, Model 1941.....	
Adjustment of the Antiaircraft Sight, Model 1941.....	
Operation of the Antiaircraft Sight, Models	
1941 and 1938 .....	

#### PART

#### PART III

### METHODS AND RULES FOR FIRING THE 12.7-mm MACHINE GUN

Chapter XIII. Methods of Machine Gun Fire .....	
General Regulations .....	
Advancing and Moving the Machine Gun into	
Firing Position .....	
Deployment of the Crew Behind the Machine Gun .....	
Loading the Machine Gun .....	
Aiming the Machine Gun at the Target .....	
Preparing to Fire on Aerial Targets .....	
Deployment of the Crew Behind the Machine Gun .....	
Transferring the Machine Gun from the Position for	
Firing on Aerial Targets to the Position for Firing	
On Ground Targets .....	
Marking the Machine Gun Aim and Reestablishing	
Aim from Marking Data .....	
Conducting Fire .....	
Chapter XIV. Regulations for Firing 12.7-mm Machine Guns .....	
General Information .....	

Selection of Firing Positions .....	
Observation of the Battlefield .....	
Target Selection .....	
Determining Distance .....	
Selection of Sight and Aiming Point .....	
Methods of Conducting Fire on Ground and Aerial	
Targets .....	
Selecting the Type of Fire.....	
Selecting the Moment for Opening Fire .....	
Observation of Results and Correction of Fire.....	
Firing on Stationary Targets .....	
Firing on Targets Which Suddenly Appear and are	
Quickly Concealed.....	
Firing on Moving Targets .....	
Firing on Invisible and Camouflaged Targets .....	
Firing in Between and Beyond the Flank of	
Friendly Units .....	
Firing at Night and Under Conditions of	
Limited Visibility.....	
Firing in Mountains .....	
Conducting Close-in Firing.....	
Registration Fire .....	
Preparation of Data for Firing .....	
Ammunition Supply .....	
Maintenance of Fire Discipline .....	

#### Appendix.

1. List of Terms Used in These Instructions .....
2. Purpose and Construction of the Universal Lyre.....
3. Firing Tables for the 12.7-mm Machine Gun,  
Models 1938/46 and 1938 on Universal Mount, Model 1938 ..

4

3

2

1